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Washington University Magazine, Spring 1963

SPRING 1963

WASHINGTON UNIVERSITY

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Magazine
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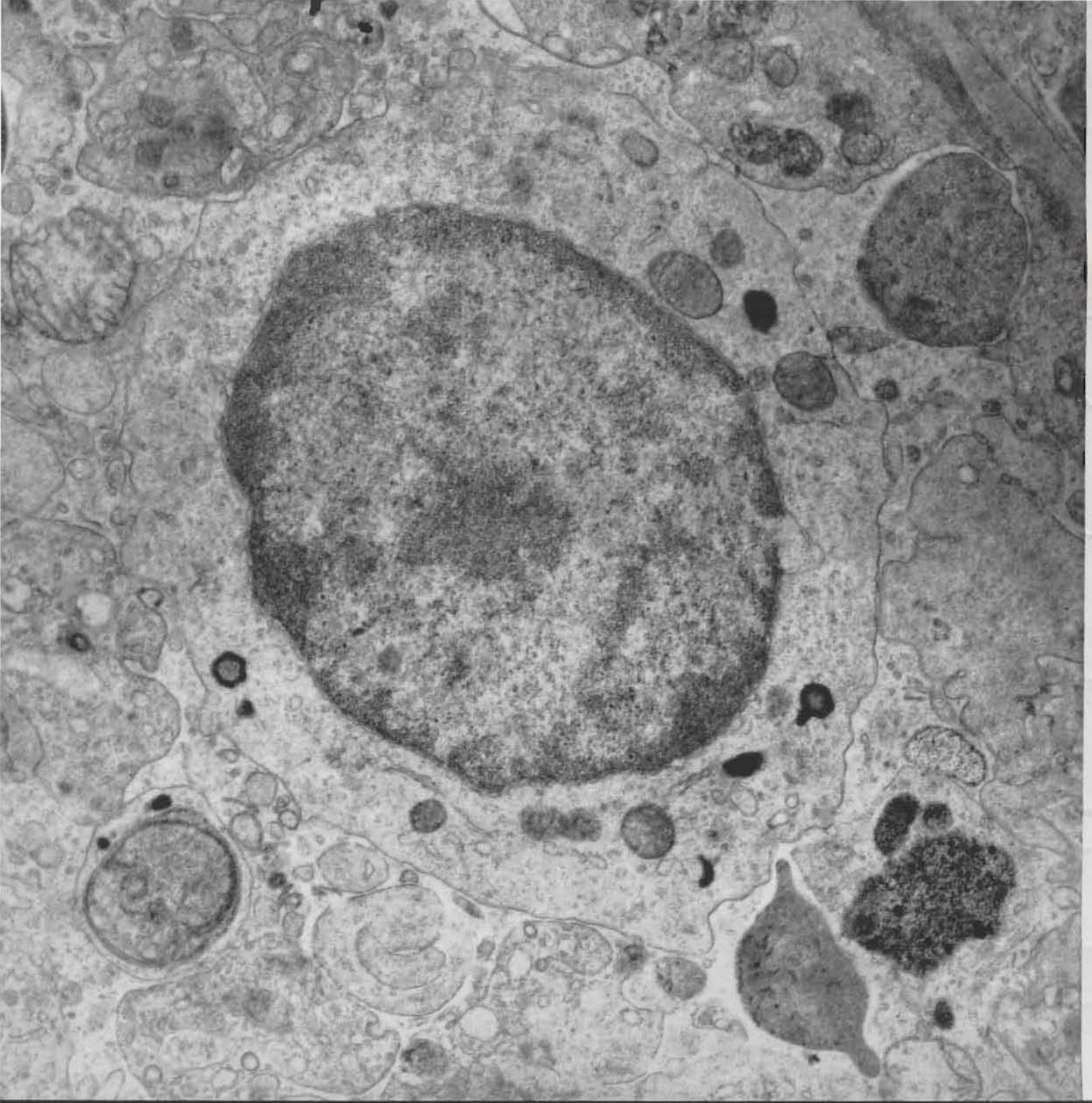
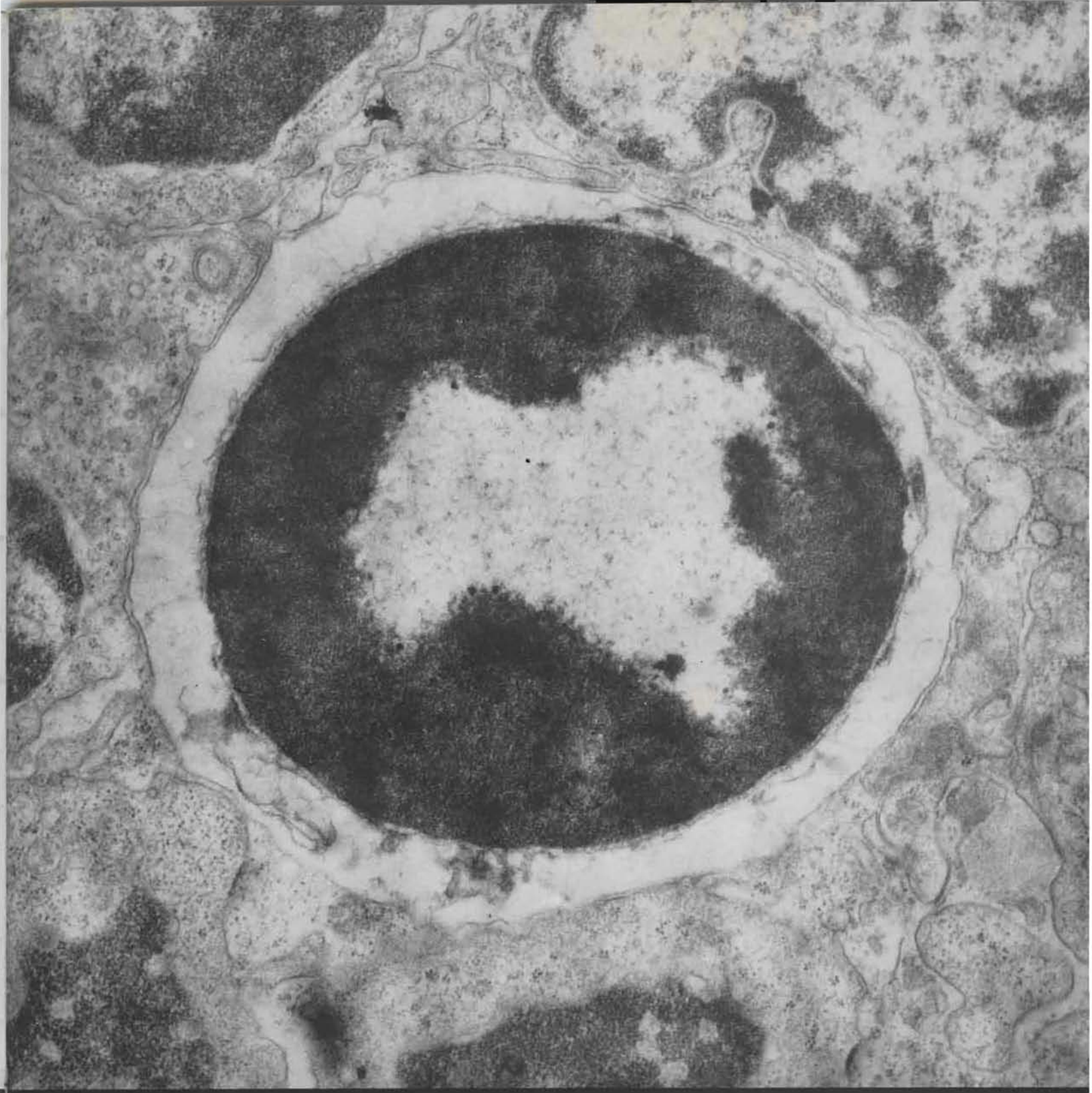
CANCER RESEARCH

ACADEMIC FREEDOM



Normal human cell under electron microscope

THE WAR against cancer is global. It is being fought on countless fronts—in universities, hospitals, government laboratories, private research centers. It is a war in which we have won a few skirmishes, but have yet to engage the enemy's main forces. It is a war that is claiming one in four of us as casualties. The attack at Washington University's School of Medicine is double-barrelled. Basic research is going on continuously into the nature of cancer in order to solve the problem by understanding it. At the same time, every available technique is being used to diagnose,



Cancerous human cell under electron microscope

treat, and control the disease while the search continues. Through pathology, radiology, surgery, and chemotherapy, the School's staff is helping to mitigate the suffering caused by cancer and is contributing toward its understanding and control. The attack is not limited to the School of Medicine. Pure research in biology, chemistry, and physics is providing both better techniques and deeper insight. In this issue, the Magazine presents a brief survey of the exciting work being done in cancer research at Washington University's School of Medicine.

Dr. Sarah A. Luse, associate professor of pathology and anatomy, with a key tool in cancer research: the electron microscope.

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Surgical pathologists L. V. Ackerman (foreground) and Walter Bauer view slides of cells taken from a patient to determine nature and extent of cancer.

Bronchoscopic technique permits inspection of lungs and respiratory tract, enables investigators to secure smears of stray cells or actual sections of tissue for inspection.

After cells have been obtained, stained, and mounted on slides, they are examined under the microscope. All atypical cells discovered are subjected to detailed study by the staff pathologists.

CANCER RESEARCH

CANCER CAN BE defined as a family of diseases characterized by abnormal growth and spread of cells. The first step in conquering cancer is to diagnose it—quickly and accurately. Methods developed to discover cancer in its early stages not only make it possible to treat the symptoms and to save lives, but they also furnish valuable clues about the nature of the disease and its possible causes. Skin cancer and external tumors can be detected easily. It is the internal varieties that are hard to find before they have progressed too far.

There are methods, however. Samples of cells can be obtained by "smear" or biopsy; by collecting stray cells discarded by the body or by slicing a tiny bit of tissue from an organ. The object in both cases is to examine the cells for telltale signs of abnormality.

Last year, the Washington University School of Medicine performed 15,000 smear tests. Twenty-five cases of cervical-vaginal cancer were discovered among 12,000 women tested and 150 lung cancer cases were found among 1,500 lung smears. After suspicious cells are discovered, the University's pathologists study the samples in minute detail to estimate the nature of the cancer, to map out its spread in the organ, and to determine the best methods of treatment.

Photographs by Herb Weitman

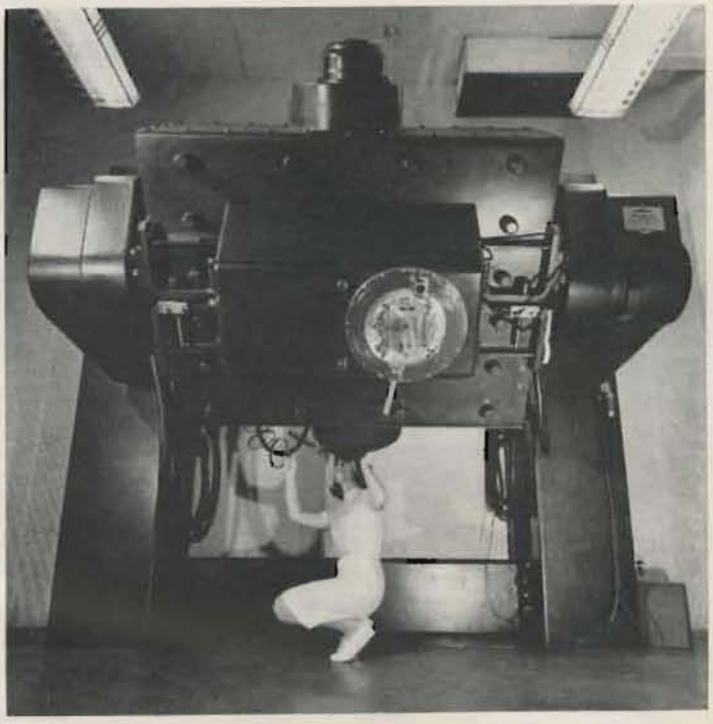
CANCER RESEARCH

Dr. Harvey R. Butcher, Jr., associate professor of surgery, performs a successful colon operation on a cancer patient.

MEDICAL SCIENCE HAS many weapons in its arsenal, but surgery is still the most important single method available for treating cancer. In the beginning, surgery was the *only* method, but now it is part of the over-all attack on the problem. Today, the surgeon can perform operations on the cancer patient that were undreamed of a generation ago. Advances in preoperative and postoperative care, in anesthesiology, and in the discovery and application of the antibiotics have resulted in tremendous progress in the art. New basic knowledge in physiology and in understanding of the blood and other body fluids, and of shock and chemical balances have also helped to enable the surgeon to take new and radical approaches to the subject and to develop new techniques.

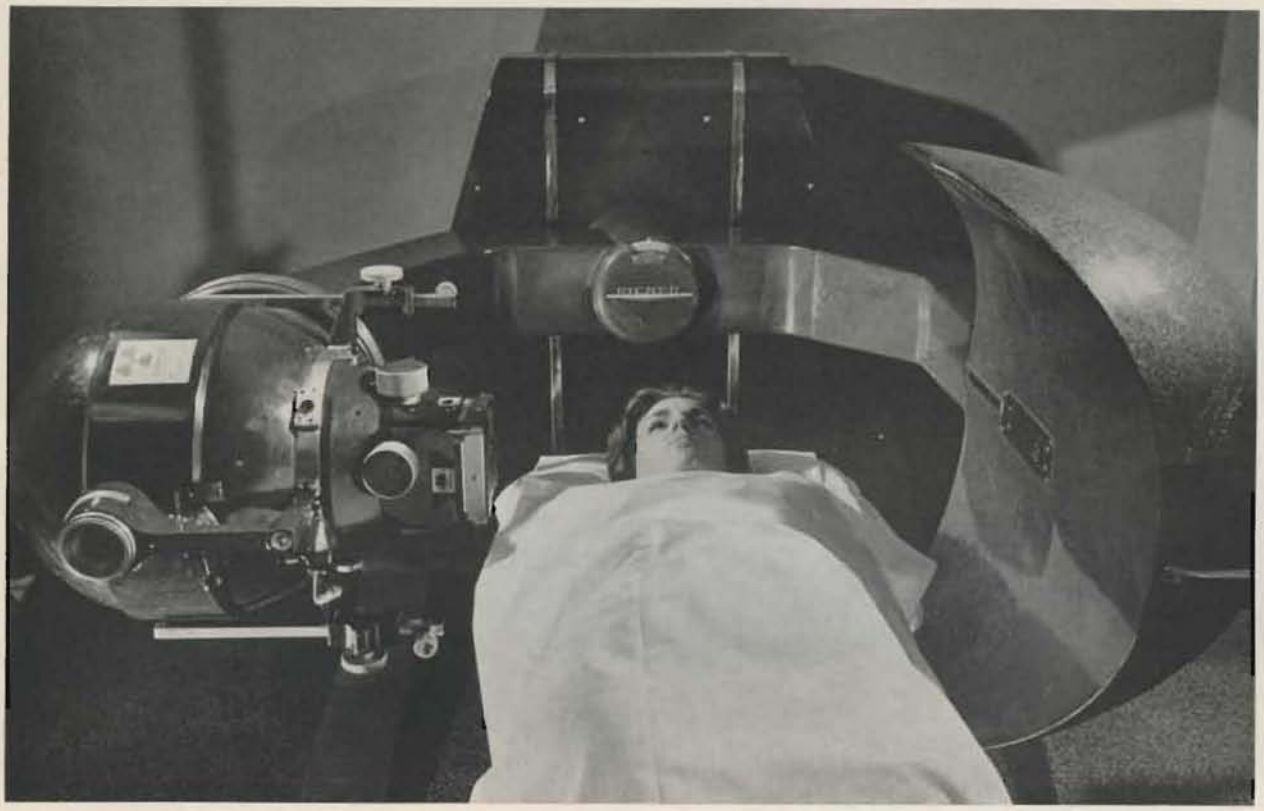
The surgeon is in an excellent position to participate in cancer research. While his work is clinical, he can make important contributions to an understanding of the disease, its manifestations, and its behavior. The quality of surgical treatment of cancer depends as much on the surgeon's knowledge of the field and his judgment as it does upon his technical skill.

Dr. William E. Powers, associate professor of radiology, uses radiation to eliminate a cancer in a laboratory mouse. Experiments measure efficiency of different types of radiation.



The betatron, one of the new tools growing out of advances in atomic science, permits use of 22 million volt x-rays in cancer cases.

The "cobalt bomb" is a machine used by the radiologist to direct the powerful radiation from radiocobalt on the site of a malignant tumor.



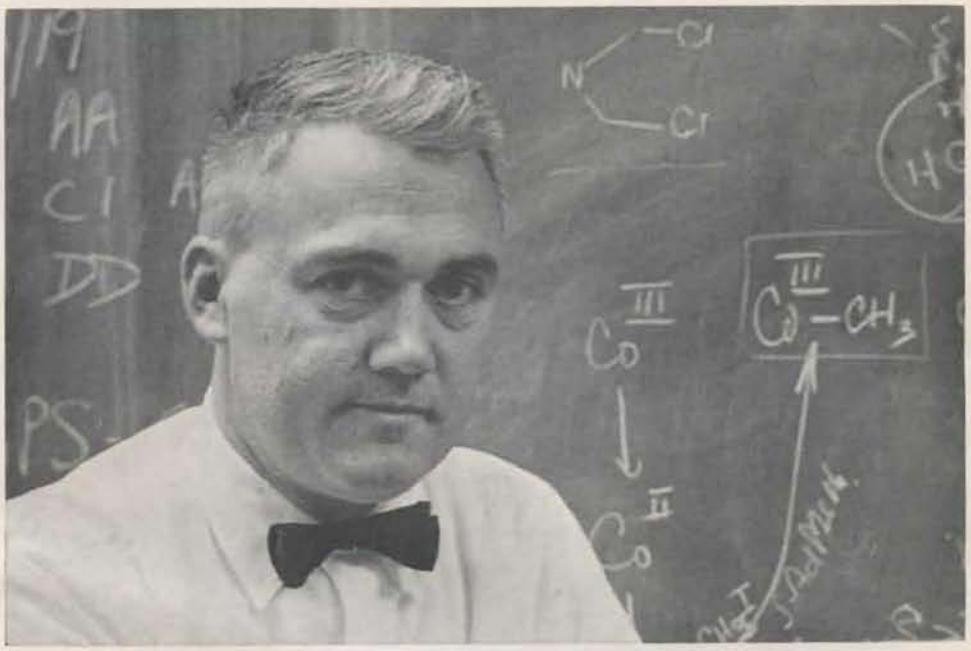
RADIOLOGY, OR THE USE of ionizing radiation to destroy tumors or to control cancer, has a history almost as long as surgery. The first method employed was the use of radium. The employment of x-rays followed shortly after. Today, advances in atomic science have produced numerous radioactive isotopes with application to cancer therapy and have also permitted the use of ultrahigh-voltages and extremely powerful beams of particles.

The radioisotopes have proven particularly valuable in both cancer detection and treatment, for certain chemicals concentrate in particular organs and some even show a preference for malignant cells. By substituting a radioactive isotope for the normal element, one can send a diagnostic or therapeutic agent directly to the site of the tumor.

Radiotherapy and surgery are often employed together in a multitude of relationships depending on the nature of the case. Sometimes radiotherapy is employed before surgery; sometimes after; sometimes in combination.

Radiation is one of the contributing causes in cancer, but it is also one of the most valuable clinical tools and one of the most promising areas of basic research.

Dr. Edward H. Reinhard and Dr. Virgil Loeb, Jr. examine a patient with cancer of the lymph nodes. Chemical agents developed in the School of Medicine's chemotherapy program were used with considerable success on the patient.



Hematologist William J. Harrington, associate professor of medicine, has been doing new and exciting work in the treatment of leukemia and in research into blood cancer.

CANCER RESEARCH

Dr. Loeb and Dr. Reinhard in the hematology laboratory at the School of Medicine. Learning that some cancers may be modified by antibodies formed in the patient's body, they are attempting to predetermine the genetic code for the formation of antibodies in leukemic cells.

CHEMOTHERAPY, or the use of chemical agents to combat cancer, is the newest and most rapidly changing development in the field. Since 1956, Dr. Virgil Loeb, Jr. and Dr. Edward H. Reinhard of the School of Medicine have conducted a cancer chemotherapy program as participants in a study group organized under the National Cancer Institute to evaluate various new drugs in the treatment of cancer. Most of the participants are hematologists, so work has centered on evaluating drugs used in the treatment of leukemia and of malignant tumors of the blood-forming organs. Lately, however, increased emphasis has been put on screening new agents in the treatment of many different types of cancer.

New chemical agents are tested under extremely strict control observation on selected patients and results are compared among all the medical schools participating in the national program. Of course, new drugs are tested first in animals and, unfortunately, many which appear to be promising for human cancer turn out to be ineffective or too toxic for use in humans. The ultimate objectives of the studies in chemotherapy are to evaluate the clinical potential of new chemical agents and to establish principles for proper dosage and duration of treatment.

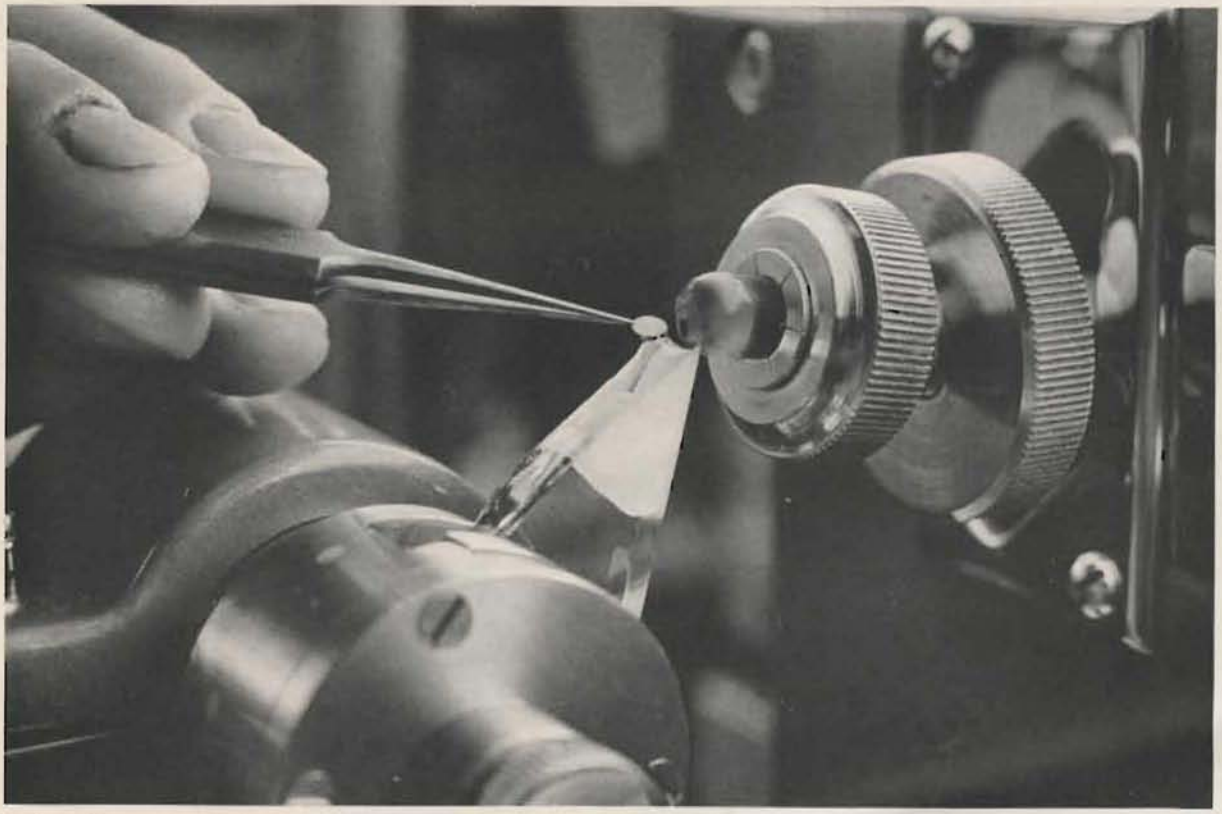
CANCER RESEARCH

THE CAUSE OF CANCER is unknown, or rather, the causes of cancers are unknown. Most investigators suspect that the primary causes are viruses and that radiation, irritation, and other carcinogenic agents merely weaken the cell's resistance to the virus. However, while it has been proven that viruses cause a variety of animal tumors, so far no virus has been proven to be the cause of a human cancer.

A great deal of progress has been made in the field through the development of the electron microscope. Using beams of electrons instead of visible light, this new tool permits direct magnification of up to 100,000 times. Washington University scientists have been studying human tumors by electron microscopy since 1955. After these years of study, the electron microscopic appearance of a tumor is often relied upon in arriving at a definitive diagnosis.

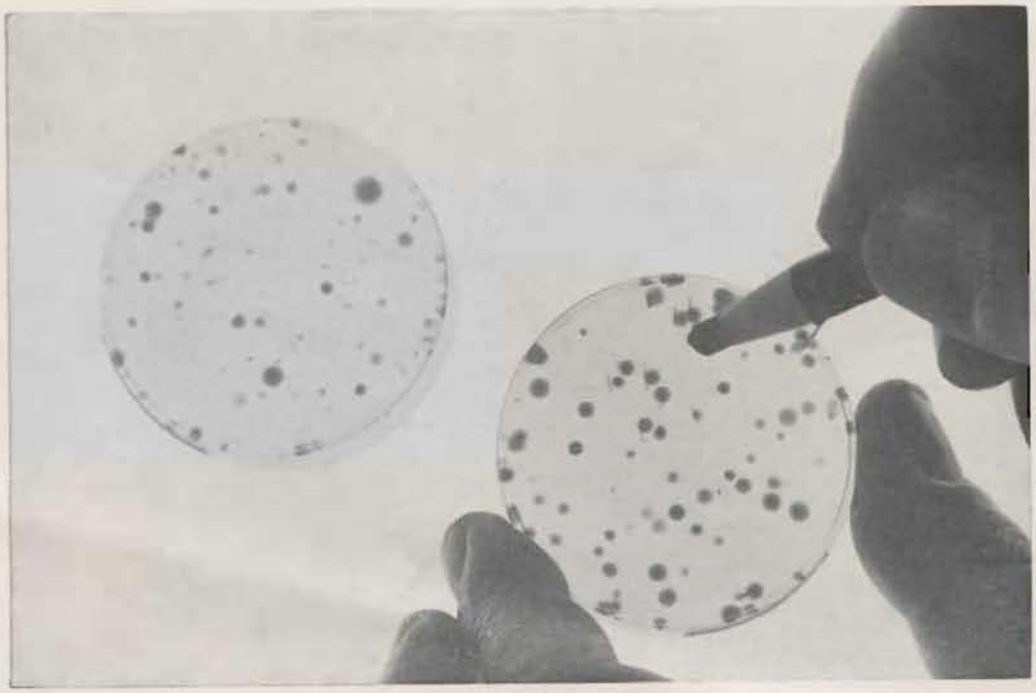
Under the electron microscope, it is possible to recognize patterns within the cell that are so distinctive that they can serve much as fingerprints do to distinguish individuals. On the basis of a few tiny granules from within a cell, one can distinguish one type of tumor from another and often pinpoint the organ from which it came.

Today, the electron microscope is not only an instrument of basic research, it is a powerful diagnostic tool. Like so much activity in the whole field of cancer, the clinical and research aspects of the work are intertwined.



Left: Making a glass knife small enough and sharp enough to slice a cell sample is delicate work. The knife is fitted into a microtome (above) and the cell section is then transferred to a tiny copper grid, stained, and placed in the field of the electron microscope.

Dr. Tolmach and his staff are directing research into the effects of radiation on living systems, especially the cell.



Cultures of cells in Medical School laboratory show the results of radiation. At left are cells that have been irradiated and at right are normal cells. Note difference in the size and shape.

Dr. Tolmach works with cultures of cells in studying the effects of radiation. The culture room is kept at a uniform temperature of 98 degrees Fahrenheit to provide the proper environment.

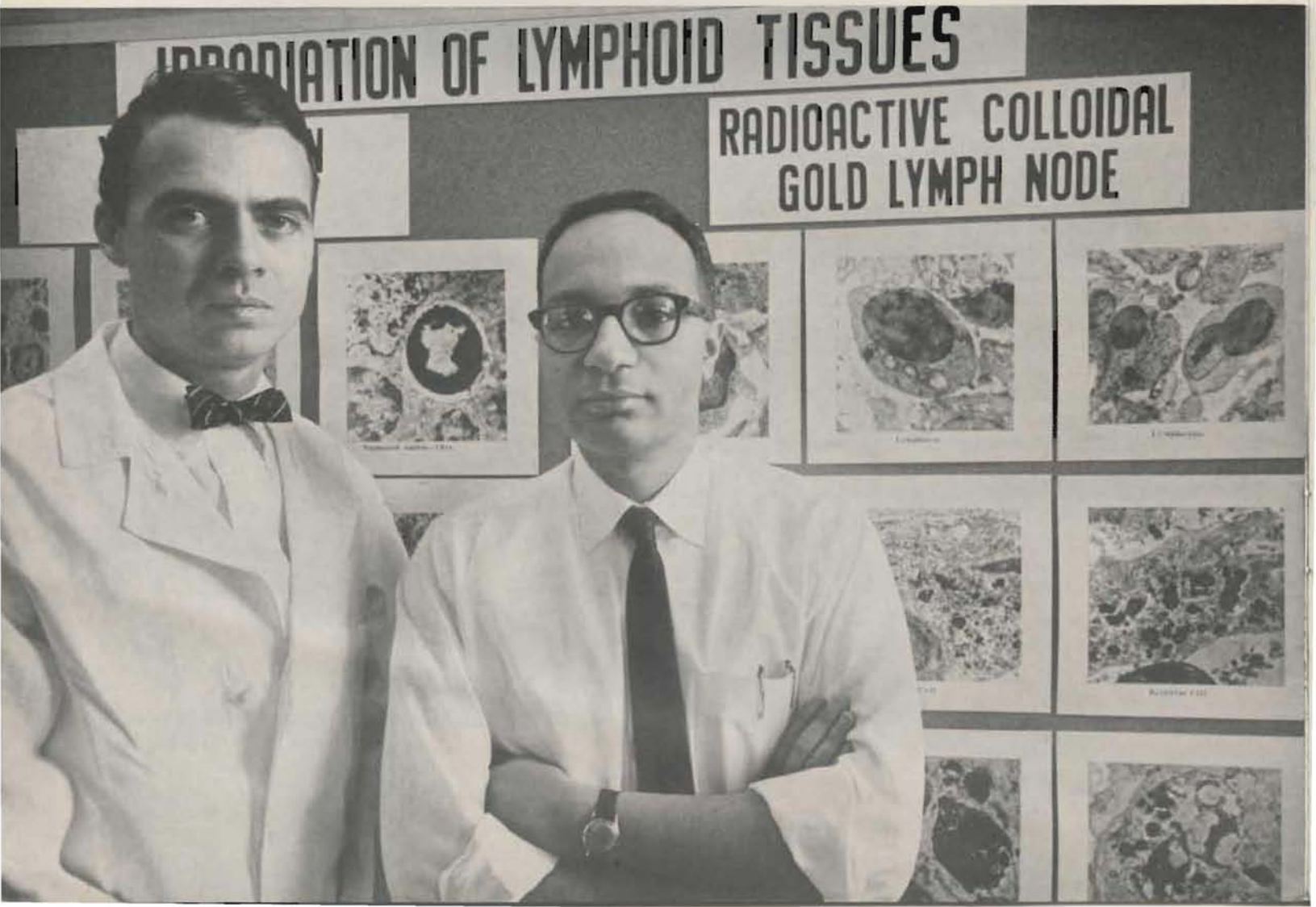
ONE EXCITING AREA of cancer research is the study of the effects of radiation on living systems, especially the cell. Dr. L. J. Tolmach, associate professor of chemistry in radiology, and his staff have been studying radiation effects in two systems: one a cultured strain originally derived from human cancer, and the other a transplantable line of mouse cancer cells.

In the first, a method of synchronizing cells has been developed in which whole cell populations go through division in phase. This method has enabled the investigators to study radiation effects during the 20 hours that elapse between cell divisions. It is hoped that the studies will lead to a more complete understanding of the effects of radiation on cells and of the molecular events that precede normal cell division.

The second project in which Dr. W. E. Powers, associate professor of radiology, has participated is a study of cell survival in animal tumors. By measuring the cell's survival in terms of its ability to cause tumors, it is possible to predict the efficacy of different radiation treatments designed to cure tumors. It is an attempt to measure the relationship between cell sensitivity and cancer curability.

CANCER RESEARCH

Pathologists G. D. Sorenson and W. A. Bari are working on the problem of why lymphocytes (white blood corpuscles arising in the lymph system) are so sensitive to x-rays. Using the electron microscope, they are attempting to follow changes within cells.



Left: Surgeon Harvey R. Bernard, who is using a radioactive isotope of potassium to investigate why the transfer of substances from the blood to brain cells is speeded up when brain tumors form. Right: a vial containing a new chemical carcinogen—a subtance which, when injected into an animal, will induce cancer.

CURRENTLY, about one million dollars per year is being spent on cancer research at the Washington University School of Medicine. This direct research is being supported by work in other areas where the application to cancer may not be immediately apparent, but from which important results may come.

The amount of research being done is enormous, but the magnitude of the problem is staggering. Now that most infectious diseases have been brought under control, cancer has become the No. 2 killer. It strikes approximately two in every three American families. However, there has been great progress. In 1937, only one in seven cancer victims was saved. Today, one in three survives. It is estimated that about 175,000 Americans will be saved from cancer death this year because of early detection and prompt and skillful treatment. Many more could be saved if they had regular examinations and sought medical care at the first symptoms.

The global war against cancer continues. At Washington University's School of Medicine, research into better detection methods and improved clinical practices, and vigorous pursuit of understanding and control of cancer are proceeding hand in hand. Some day, these investigators are convinced, the riddle will be solved and the world freed of this scourge.


KMOX

THIS ORIGINAL article by Sir Charles P. Snow is based on the address the eminent British scientist-novelist gave at Washington University's 1963 Founders Day banquet. In it, he warns that the world is on the verge of a "major leap" in biological science, the consequences of which may be more far-reaching than those of the revolution in physics.

Trained as a scientist, C. P. Snow was a research physicist at Cambridge University before he began to win international fame for his series of novels. During World War II, he was technical adviser to the British government on scientific manpower. His 1959 lecture at Cambridge on "The Two Cultures and the Scientific Revolution" has been the subject of world-wide controversy ever since.

Long considered a spokesman for the scientific community, Sir Charles has been increasingly concerned with the new discoveries being made on the frontiers of the life sciences and their impact on society. This article is his first major statement of that concern.

SCIENCE AND THE AMERICAN DREAM

By C. P. SNOW

I AM MUCH MOVED to be here and I can't help various echoes running through my mind. I think of a namesake and relative of yours, Mr. Chancellor, who lived in this city, became a great poet, and did our country the honor of taking its nationality. And I think, too, of a predecessor of yours as Chancellor, Arthur Holly Compton who was very well known in England. We loved him, partly because he was a fine scientist, but more because he represented to us the twentieth-century American—American to the marrow of his bones.

This is a great university. Its fame in some respects is world-wide. The names of Erlanger and the Coris have reached miles beyond the frontiers of the United States. And I must say I have never been in any other university which seemed to me to be right on the threshold of breaking through to a new greatness. From the impressions of forty-eight hours, I feel you are bursting at the seams. It is exhilarating and touching to be able to share with you even for a short time some part of that experience. I suspect your next decade is going to be a wonderful decade and we are going to take back to St. Andrews, of which I happen to be honorary president or rector, something of the feeling which we sense around us here. It seems to me you represent with vividness and actuality some of the things which America in this next generation, or maybe sooner than that, is going to give to the world.

That is why I thought of talking to you for a few minutes about "Science and the American Dream." For here and now in this university you seem to me the symbol and essence of some of the things which America ought to be most proud of. Yet are you? It often puzzles those of us who know you a little and love you a lot to see the things you are proud of and those you are not. I suppose this is true of all countries, but it does seem especially true of you. There are things you congratulate yourself upon that to outside observers don't seem all that wonderful. I am not going to specify these delicate matters, for it seems to me the less Anglo-American back-chat we allow ourselves at this particular moment, the bet-

Continued on Page 37

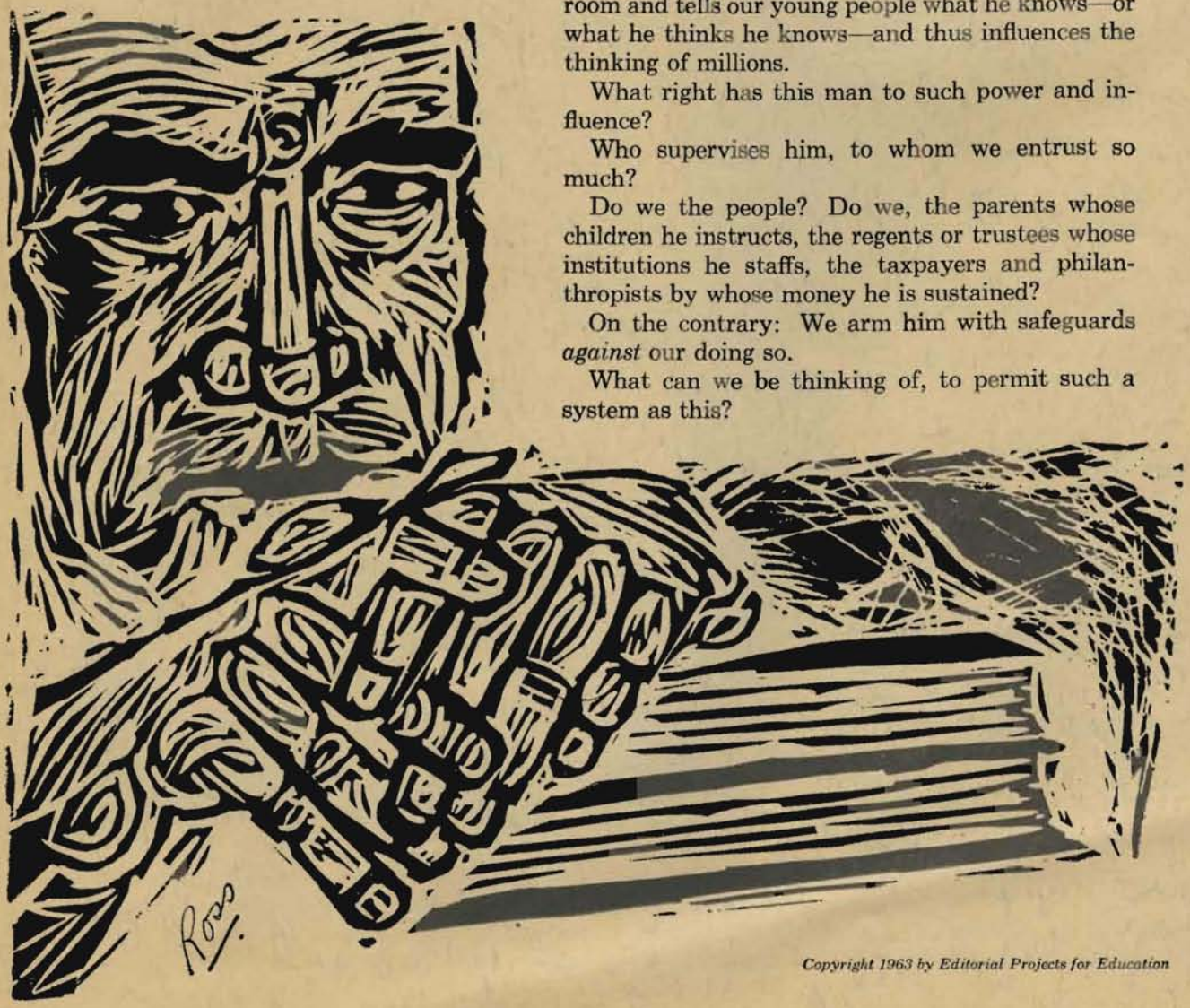
ON THE OPPOSITE PAGE

begins a 16-page national study of the nature and meaning of academic freedom. This special report is a cooperative endeavor in which many colleges, including Washington University, participated.

To prepare this report, the editors visited campuses throughout the country and talked to college presidents and administrators and to faculty and students. They talked, too, to parents and to alumni, to trustees and legislators, to businessmen and lawyers and newspaper editors. They sifted through bales of written material on the subject and digested tons of articles and files and case histories.

The result is a thoughtful, thorough analysis of the concept of academic freedom and how this concept operates in our society. It concerns each of us in many obvious ways and in many ways that are not so obvious. The question of academic freedom, this report illustrates, is far from academic.

WHAT RIGHT HAS THIS MAN...



HE HOLDS a position of power equaled by few occupations in our society.

His influence upon the rest of us—and upon our children—is enormous.

His place in society is so critical that no totalitarian state would (or does) trust him fully. Yet in our country his fellow citizens grant him a greater degree of freedom than they grant even to themselves.

He is a college teacher. It would be difficult to exaggerate the power that he holds.

- He originates a large part of our society's new ideas and knowledge.
- He is the interpreter and disseminator of the knowledge we have inherited from the past.
- He makes discoveries in science that can both kill us and heal us.
- He develops theories that can change our economics, our politics, our social structures.
- As the custodian, discoverer, challenger, tester, and interpreter of knowledge he then enters a classroom and tells our young people what he knows—or what he thinks he knows—and thus influences the thinking of millions.

What right has this man to such power and influence?

Who supervises him, to whom we entrust so much?

Do we the people? Do we, the parents whose children he instructs, the regents or trustees whose institutions he staffs, the taxpayers and philanthropists by whose money he is sustained?

On the contrary: We arm him with safeguards *against* our doing so.

What can we be thinking of, to permit such a system as this?

Having ideas, and disseminating them, is a risky business. It has always been so—and therein lies a strange paradox. The march of civilization has been quick or slow in direct ratio to the production, testing, and acceptance of ideas; yet virtually all great ideas were opposed when they were introduced. Their authors and teachers have been censured, ostracized, exiled, martyred, and crucified—

usually because the ideas clashed with an accepted set of beliefs or prejudices or with the interests of a ruler or privileged class.

Are we wiser and more receptive to ideas today? Even in the Western world, although methods of punishment have been refined, the propagator of a new idea may find himself risking his social status, his political acceptability, his job, and hence his very livelihood.

For the teacher: special risks, special rights

NORMALLY, in our society, we are wary of persons whose positions give them an opportunity to exert unusual power and influence.

But we grant the college teacher a degree of freedom far greater than most of the rest of us enjoy.

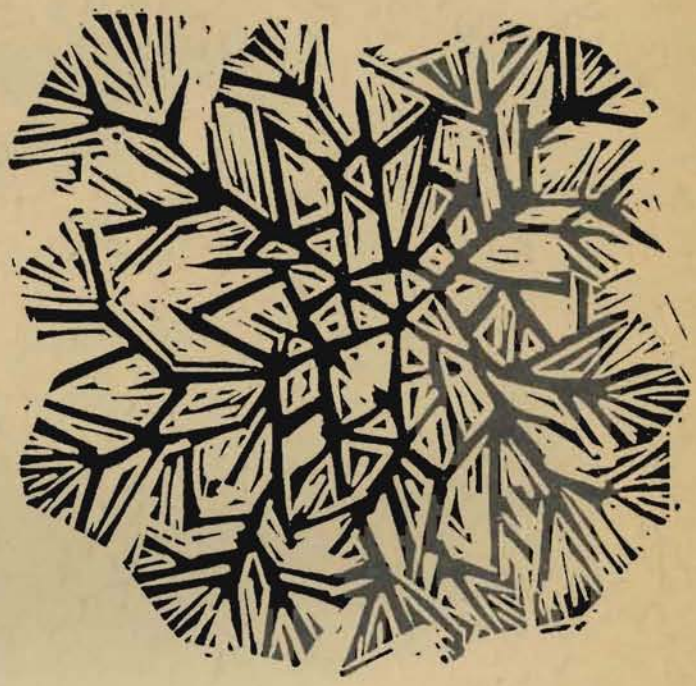
Our reasoning comes from a basic fact about our civilization:

Its vitality flows from, and is sustained by, *ideas*.

Ideas in science, ideas in medicine, ideas in politics. Ideas that sometimes rub people the wrong way. Ideas that at times seem pointless. Ideas that may alarm, when first broached. Ideas that may be so novel or revolutionary that some persons may propose that they be suppressed. Ideas—all sorts—that provide the sinews of our civilization.

They will be disturbing. Often they will irritate.

But the more freely they are produced—and the more rigorously they are tested—the more surely will our civilization stay alive.



THIS IS THE THEORY. Applying it, man has developed institutions for the specific purpose of incubating, nourishing, evaluating, and spreading ideas. They are our colleges and universities. As their function is unique, so is the responsibility with which we charge the man or woman who staffs them.

We give the college teacher the professional duty of pursuing knowledge—and of conveying it to others—with complete honesty and open-mindedness. We tell him to find errors in what we now know. We tell him to plug the gaps in it. We tell him to add new material to it.

We tell him to do these things without fear of the consequences and without favor to any interest save the pursuit of truth.

We know—and he knows—that to meet this responsibility may entail risk for the college teacher. The knowledge that he develops and then teaches to others will frequently produce ground-shaking results.

It will lead at times to weapons that at the press of a button can erase human lives. Conversely, it will lead at other times to medical miracles that will *save* human lives. It may unsettle theology, as did Darwinian biology in the late 1800's, and as did countless other discoveries in earlier centuries. Conversely, it may confirm or strengthen the elements of one's faith. It will produce intensely personal results: the loss of a job to automation or, conversely, the creation of a job in a new industry.

Dealing in ideas, the teacher may be subjected to strong, and at times bitter, criticism. It may come from unexpected quarters: even the man or woman who is well aware that free research and education are essential to the common good may become understandably upset when free research and education affect his own livelihood, his own customs, his own beliefs.

And, under stress, the critics may attempt to coerce the teacher. The twentieth century has its own versions of past centuries' persecutions: social ostracism for the scholar, the withdrawal of financial support, the threat of political sanctions, an attempt to deprive the teacher of his job.

Wherever coercion has been widely applied—in Nazi Germany, in the Soviet Union—the development of ideas has been seriously curtailed. Were

such coercion to succeed here, the very sinews of our civilization would be weakened, leaving us without strength.

WE RECOGNIZE these facts. So we have developed special safeguards for ideas, by developing special safeguards for him who fosters ideas: the college teacher.

We have developed these safeguards in the calm (and civilized) realization that they are safeguards against our own impetuousness in times of stress. They are a declaration of our willingness to risk the consequences of the scholar's quest for truth. They are, in short, an expression of our belief that we should seek the truth because the truth, in time, shall make us free.

What the teacher's special rights consist of

THE SPECIAL FREEDOM that we grant to a college teacher goes beyond anything guaranteed by law or constitution.

As a citizen like the rest of us, he has the right to speak critically or unpopularly without fear of governmental reprisal or restraint.

As a teacher enjoying a *special* freedom, however, he has the right to speak without restraint not only from government but from almost any other source, including his own employer.

Thus—although he draws his salary from a college or university, holds his title in a college or university, and does his work at a college or university—he has an independence from his employer which in most other occupations would be denied to him.

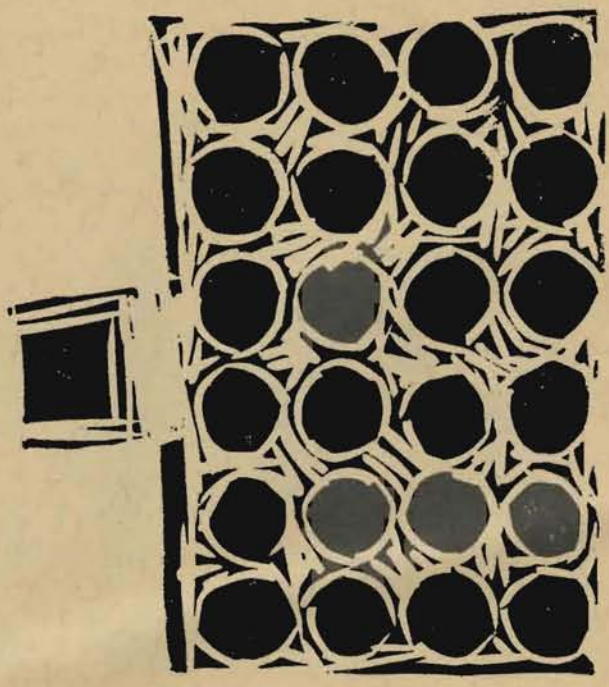
Here are some of the rights he enjoys:

- He may, if his honest thinking dictates, expound views that clash with those held by the vast majority of his fellow countrymen. He will not be restrained from doing so.
- He may, if his honest thinking dictates, publicly challenge the findings of his closest colleagues, even if they outrank him. He will not be restrained from doing so.
- He may, if his honest thinking dictates, make statements that oppose the views of the president of his college, or of a prominent trustee, or of a generous benefactor, or of the leaders of the state legislature. No matter how much pain he may bring to such persons, or to the college administrators entrusted with maintaining good relations with them, he will not be restrained from doing so.

Such freedom is not written into law. It exists on the college campus because (1) the teacher claims and enforces it and (2) the public, although wincing on occasion, grants the validity of the teacher's claim.

WE GRANT the teacher this special freedom for our own benefit.

Although "orthodox" critics of education frequently protest, there is a strong experimental emphasis in college teaching in this country. This emphasis owes its existence to several influences, including the utilitarian nature of our society; it is one of the ways in which our institu-



tions of higher education differ from many in Europe.

Hence we often measure the effectiveness of our colleges and universities by a pragmatic yardstick: Does our society derive a practical benefit from their practices?

The teacher's special freedom meets this test. The unfettered mind, searching for truth in science, in philosophy, in social sciences, in engineering, in professional areas—and then teaching the findings to millions—has produced impressive practical results, whether or not these were the original objectives of its search:

The technology that produced instruments of victory in World War II. The sciences that have produced, in a matter of decades, incredible gains in man's struggle against disease. The science and engineering that have taken us across the threshold of outer space. The dazzling progress in agricultural productivity. The damping, to an unprecedented degree, of wild fluctuations in the business cycle. The appearance and application of a new architecture. The development of a "scientific approach" in the management of business and of labor unions. The ever-increasing maturity and power of our historians, literary critics, and poets. The graduation of hundreds of thousands of college-trained men and women with the wit and skill to learn and broaden and apply these things.

Would similar results have been possible without campus freedom? In moments of national panic (as when the Russians appear to be outdistancing us in the space race), there are voices that suggest that less freedom and more centralized direction of our educational and research resources would be more "efficient." Disregard, for a moment, the fact that such contentions display an appalling ignorance and indifference about the fundamental philosophies of freedom, and answer them on their own ground. Weighed carefully, the evidence seems generally to support the contrary view. Freedom does work—quite practically.

Many point out that there are even more important reasons for supporting the teacher's special freedom than its practical benefits. Says one such person, the conservative writer Russell Kirk:

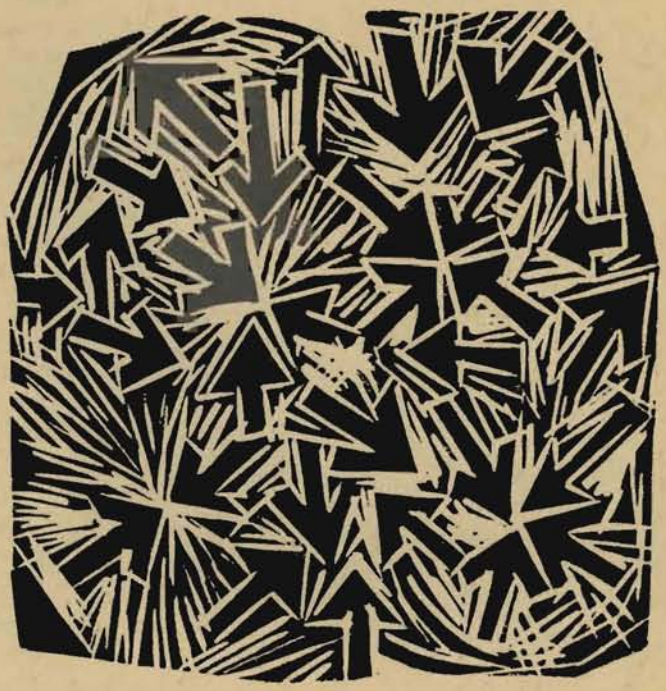
"I do not believe that academic freedom deserves preservation chiefly because it 'serves the community,' although this incidental function is important. I think, rather, that the principal importance of academic freedom is the opportunity it affords for the highest development of private reason and imagination, the improvement of mind and heart by the apprehension of Truth, whether or not that development is of any immediate use to 'democratic society'."

The conclusion, however, is the same, whether the reasoning is conducted on practical, philosophical, or religious grounds—or on all three: The unusual freedom claimed by (and accorded to) the college teacher is strongly justified.

"This freedom is immediately applicable only to a limited number of individuals," says the statement of principles of a professors' organization, "but it is profoundly important for the public at large. It safeguards the methods by which we explore the unknown and test the accepted. It may afford a key to open the way to remedies for bodily or social ills, or it may confirm our faith in the familiar. Its preservation is necessary if there is to be scholarship in any true sense of the word. The advantages accrue as much to the public as to the scholars themselves."

Hence we give teachers an extension of freedom—*academic* freedom—that we give to no other group in our society: a special set of guarantees designed to encourage and insure their boldness, their forthrightness, their objectivity, and (if necessary) their criticism of us who maintain them.

The idea works most of the time, but . . .



LIKE MANY good theories, this one works for most of the time at most colleges and universities. But it is subject to continual stresses. And it suffers occasional, and sometimes spectacular, breakdowns.

If past experience can be taken as a guide, at this very moment:

▸ An alumnus is composing a letter threatening to strike his alma mater from his will unless the institution removes a professor whose views on some controversial issue—in economics? in genetics? in politics?—the alumnus finds objectionable.

▸ The president of a college or university, or one of his aides, is composing a letter to an alumnus in which he tries to explain why the institution *cannot* remove a professor whose views on some controversial issue the alumnus finds objectionable.

▸ A group of liberal legislators, aroused by reports from the campus of their state university that a professor of economics is preaching fiscal conservatism, is debating whether it should knock some sense into the university by cutting its appropriation for next year.

▸ A group of conservative legislators is aroused by reports that another professor of economics is preaching fiscal liberalism. This group, too, is considering an appropriation cut.

▸ The president of a college, faced with a budgetary crisis in his biology department, is pondering whether or not he should have a heart-to-heart chat with a teacher whose views on fallout, set forth in a letter to the local newspaper, appear to be scaring away the potential donor of at least one million dollars.

▸ The chairman of an academic department, still smarting from the criticism that two colleagues leveled at the learned paper he delivered at the departmental seminar last week, is making up the new class schedules and wondering why the two upstarts wouldn't be just the right persons for those 7 a.m. classes which increased enrollments will necessitate next year.

▸ The educational board of a religious denomination is wondering why it should continue to permit the employment, at one of the colleges under its control, of a teacher of religion who is openly questioning a doctrinal pronouncement made recently by the denomination's leadership.

▸ The managers of an industrial complex, worried by university research that reportedly is linking their product with a major health problem, are wondering how much it might cost to sponsor university research to show that their product is *not* the cause of a major health problem.

Pressures, inducements, threats: scores of examples, most of them never publicized, could be cited each year by our colleges and universities.

In addition there is philosophical opposition to the present concept of academic freedom by a few who sincerely believe it is wrong. ("In the last analysis," one such critic, William F. Buckley, Jr., once wrote, "academic freedom must mean the freedom of men and women to supervise the educational activities and aims of the schools they oversee and support.") And, considerably less important and more frequent, there is opposition by emotionalists and crackpots.

Since criticism and coercion do exist, and since academic freedom has virtually no basis in law, how can the college teacher enforce his claim to it?

In the face of pressures, how the professor stays free

IN THE mid-1800's, many professors lost their jobs over their views on slavery and secession. In the 1870's and '80's, many were dismissed for their views on evolution. Near the turn of the century, a number lost their jobs for speaking out on the issue of Free Silver.

The trend alarmed many college teachers. Until late in the last century, most teachers on this side of the Atlantic had been mere purveyors of the knowledge that others had accumulated and written down. But, beginning around 1870, many began to perform a dual function: not only did they teach, but they themselves began to investigate the world about them.

Assumption of the latter role, previously performed almost exclusively in European universities, brought a new vitality to our campuses. It also brought perils that were previously unknown. As long as they had dealt only in ideas that were classical, generally accepted, and therefore safe, teachers and the institutions of higher learning did little that might offend their governing boards, their alumni, the parents of their students, the public, and the state. But when they began to act as investigators in new areas of knowledge, they found themselves affecting the status quo and the interests of those who enjoyed and supported it.

And, as in the secession, evolution, and silver controversies, retaliation was sometimes swift.

In 1915, spurred by their growing concern over such infringements of their freedom, a group of teachers formed the American Association of University Professors. It now has 52,000 members, in the United States and Canada. For nearly half a century an AAUP committee, designated as "Committee A," has been academic freedom's most active —and most effective—defender.

THE AAUP'S defense of academic freedom is based on a set of principles that its members have developed and refined throughout the organization's history. Its current statement of these principles, composed in collaboration with the Association of American Colleges, says in part:

"Institutions of higher education are conducted for the common good and not to further the interest of either the individual teacher or the institution as a whole. The common good depends upon the free search for truth and its free exposition."

The statement spells out both the teacher's rights and his duties:

"The teacher is entitled to full freedom in research and in the publication of the results, subject to the adequate performance of his other academic duties . . .

"The teacher is entitled to freedom in the classroom in discussing his subject, but he should be careful not to introduce . . . controversial matter which has no relation to his subject . . .

"The college or university teacher is a citizen, a member of a learned profession, and an officer of an educational institution. When he speaks or writes as a citizen, he should be free from institutional censorship or discipline, but his special position in the community imposes special obligations. As a man of learning and an educational officer, he should remember that the public may judge his profession and his institution by his utterances. Hence he should at all times be accurate, should exercise appropriate restraint, should show respect for the opinions of others, and should make every effort to indicate that he is not an institutional spokesman."

HOW CAN such claims to academic freedom be enforced? How can a teacher be protected against retaliation if the truth, as he finds it and teaches it, is unpalatable to those who employ him?

The American Association of University Profes-

sors and the Association of American Colleges have formulated this answer: permanent job security, or *tenure*. After a probationary period of not more than seven years, agree the AAUP and the AAC, the teacher's services should be terminated "only for adequate cause."

If a teacher were dismissed or forced to resign simply because his teaching or research offended someone, the cause, in AAUP and AAC terms, clearly would not be adequate.

The teacher's recourse? He may appeal to the AAUP, which first tries to mediate the dispute without publicity. Failing such settlement, the AAUP conducts a full investigation, resulting in a full report to Committee A. If a violation of academic freedom and tenure is found to have occurred, the committee publishes its findings in the association's *Bulletin*, takes the case to the AAUP membership, and often asks that the offending college or university administration be censured.

So effective is an AAUP vote of censure that most college administrators will go to great lengths to avoid it. Although the AAUP does not engage in boycotts, many of its members, as well as others in the academic profession, will not accept jobs in censured institutions. Donors of funds, including many philanthropic foundations, undoubtedly are influenced; so are many parents, students, alumni, and present faculty members. Other organizations, such as the American Association of University Women, will not recognize a college on the AAUP's censure list.

As the present academic year began, eleven institutions were on the AAUP's list of censured administrations. Charges of infringements of academic freedom or tenure were being investigated on fourteen other campuses. In the past three years, seven institutions, having corrected the situations which had led to AAUP action, have been removed from the censure category.

Has the teacher's freedom no limitations?

HOW SWEEPING is the freedom that the college teacher claims?

Does it, for example, entitle a member of the faculty of a church-supported college or university openly to question the existence of God?

Does it, for example, entitle a professor of botany to use his classroom for the promulgation of political beliefs?

Does it, for example, apply to a Communist?

There are those who would answer some, or all, such questions with an unqualified Yes. They would argue that academic freedom is absolute. They would say that any restriction, however it may be rationalized, effectively negates the entire academic-freedom concept. "You are either free or not free," says one. "There are no halfway freedoms."

There are others—the American Association of University Professors among them—who say that freedom *can* be limited in some instances and, by definition, *is* limited in others, without fatal damage being done.

Restrictions at church-supported colleges and universities

The AAUP-AAC statement of principles of academic freedom implicitly allows religious restrictions:

"Limitations of academic freedom because of religious or other aims of the institution should be clearly stated in writing at the time of [the teacher's] appointment . . ."

Here is how one church-related university (Prot-

estant) states such a "limitation" to its faculty members:

"Since X University is a Christian institution supported by a religious denomination, a member of its faculty is expected to be in sympathy with the university's primary objective—to educate its students within the framework of a Christian culture. The rights and privileges of the instructor should, therefore, be exercised with discretion and a sense of loyalty to the supporting institution . . . The right of dissent is a correlative of the right of assent. Any undue restriction upon an instructor in the exercise of this function would foster a suspicion of intolerance, degrade the university, and set the supporting denomination in a false light before the world."

Another church-related institution (Roman Catholic) tells its teachers:

"While Y College is operated under Catholic auspices, there is no regulation which requires all members of the faculty to be members of the Catholic faith. A faculty member is expected to maintain a standard of life and conduct consistent with the philosophy and objectives of the college. Accordingly, the integrity of the college requires that all faculty members shall maintain a sympathetic attitude toward Catholic beliefs and practices, and shall make a sincere effort to appreciate these beliefs and practices. Members of the faculty who are Catholic are expected to set a good example by the regular practice of Catholic duties."

A teacher's "competence"

By most definitions of academic freedom, a teacher's rights in the classroom apply only to the field in which he is professionally an expert, as determined by the credentials he possesses. They do not extend to subjects that are foreign to his specialty.

". . . He should be careful," says the American Association of University Professors and the Association of American Colleges, "not to introduce into his teaching controversial matter which has no relation to his subject."

Hence a professor of botany enjoys an undoubted freedom to expound his botanical knowledge, however controversial it might be. (He might discover, and teach, that some widely consumed cereal grain, known for its energy-giving properties, actually is of little value to man and animals, thus causing consternation and angry outcries in Battle Creek. No one on the campus is likely to challenge his right to do so.) He probably enjoys the right to comment, from a botanist's standpoint, upon a conservation bill pending in Congress. But the principles of academic freedom might not entitle the botanist to take

a classroom stand on, say, a bill dealing with traffic laws in his state.

As a private citizen, of course, off the college campus, he is as free as any other citizen to speak on whatever topic he chooses—and as liable to criticism of what he says. He has no special privileges when he acts outside his academic role. Indeed, the AAUP-AAC statement of principles suggests that he take special pains, when he speaks privately, not to be identified as a spokesman for his institution.

HENCE, at least in the view of the most influential of teachers' organizations, the freedom of the college teacher is less than absolute. But the limitations are established for strictly defined purposes: (1) to recognize the religious auspices of many colleges and universities and (2) to lay down certain ground rules for scholarly procedure and conduct.

In recent decades, a new question has arisen to haunt those who would define and protect academic freedom: the problem of the Communist. When it began to be apparent that the Communist was not simply a member of a political party, willing (like other political partisans) to submit to established democratic processes, the question of his eligibility to the rights of a free college teacher was seriously posed.

So pressing—and so worrisome to our colleges and universities—has this question become that a separate section of this report is devoted to it.

The Communist: a special case?

SHOULD A Communist Party member enjoy the privileges of academic freedom? Should he be permitted to hold a position on a college or university faculty?

On few questions, however "obvious" the answer may be to some persons, can complete agreement be found in a free society. In a group as conditioned to controversy and as insistent upon hard proof as are college teachers, a consensus is even more rare.

It would thus be a miracle if there were agreement on the rights of a Communist Party member to enjoy academic privileges. Indeed, the miracle has not yet come to pass. The question is still warmly debated on many campuses, even where there is not a Communist in sight. The American Association of University Professors is still in the process of defining its stand.

The difficulty, for some, lies in determining whether or not a communist teacher actually propagates his beliefs among students. The question is asked, Should a communist gym instructor, whose utterances to his students are confined largely to the hup-two-three-four that he chants when he leads the calisthenics drill, be summarily dismissed? Should a chemist, who confines his campus activities solely to chemistry? Until he overtly preaches communism, or permits it to taint his research, his writings, or his teaching (some say), the Communist should enjoy the same rights as all other faculty members.

Others—and they appear to be a growing number—have concluded that proof of Communist Party membership is in itself sufficient grounds for dismissal from a college faculty.

To support the argument of this group, Professor Arthur O. Lovejoy, who in 1913 began the movement that led to the establishment of the AAUP, has quoted a statement that he wrote in 1920, long before communism on the campus became a lively issue:

"Society . . . is not getting from the scholar the particular service which is the principal *raison d'être* of his calling, unless it gets from him his honest report of what *he* finds, or believes, to be true, after careful study of the problems with which he deals. Insofar, then, as faculties are made up of men whose teachings express, *not* the results of their own research and reflection and that of their fellow-specialists, but rather the opinions of other men—whether holders of public office or private persons from whom endowments are received—just so far are colleges and universities perverted from their proper function . . ."

(His statement is the more pertinent, Professor Lovejoy notes, because it was originally the basis of "a criticism of an American college for accepting from a 'capitalist' an endowment for a special professorship to be devoted to showing 'the fallacies of socialism and kindred theories and practices.' I have now added only the words 'holders of public office.' ")

Let us quote Professor Lovejoy at some length, as he looks at the communist teacher today:

"It is a very simple argument; it can best be put, in the logician's fashion, in a series of numbered theorems:

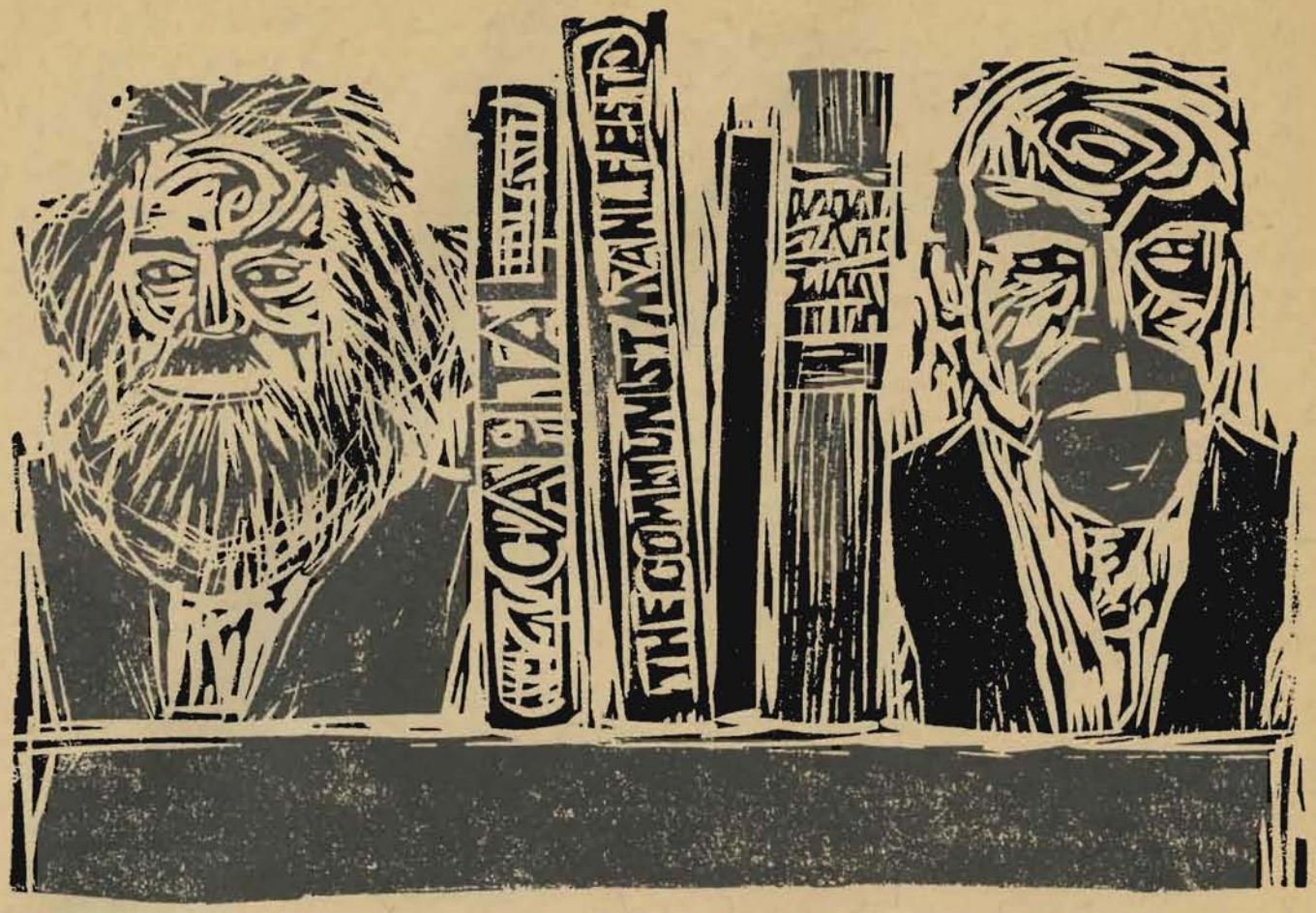
"1. Freedom of inquiry, of opinion, and of teaching in universities is a prerequisite, if the academic scholar is to perform the proper function of his profession.

"2. The Communist Party in the United States is an organization whose aim is to bring about the establishment in this country of a political as well as an economic system essentially similar to that which now exists in the Soviet Union.

"3. That system does not permit freedom of inquiry, of opinion, and of teaching, either in or outside of universities; in it the political government claims and exercises the right to dictate to scholars what conclusions they must accept, or at least profess to accept, even on questions lying within their own specialties—for example, in philosophy, in history, in aesthetics and literary criticism, in economics, in biology.

"4. A member of the Communist Party is therefore engaged in a movement which has already extinguished academic freedom in many countries and would—if it were successful here—result in the abolition of such freedom in American universities.

"5. No one, therefore, who desires to maintain



academic freedom in America can consistently favor that movement, or give indirect assistance to it by accepting as fit members of the faculties of universities, persons who have voluntarily adhered to an organization one of whose aims is to abolish academic freedom.

"Of these five propositions, the first is one of principle. For those who do not accept it, the conclusion does not follow. The argument is addressed only to those who do accept that premise. The second, third, and fourth propositions are statements of fact. I submit that they cannot be honestly gainsaid by any who are acquainted with the relevant facts . . .

"It will perhaps be objected that the exclusion of communist teachers would itself be a restriction upon freedom of opinion and of teaching—*viz.*, of the opinion and teaching that intellectual freedom should be abolished in and outside of universities; and that it is self-contradictory to argue for the restriction of freedom in the name of freedom. The argument has a specious air of logicality, but it is in fact an absurdity. The believer in the indispensability of freedom, whether academic or political, is not thereby committed to the conclusion that it is his duty to facilitate its destruction, by placing its enemies in strategic positions of power, prestige, or influence . . . The conception of freedom is not one which implies the legitimacy and inevitability of its own suicide. It is, on the contrary, a conception which, so to say, defines the limit of its own applicability; what it implies is that there is *one* kind of freedom which is inadmissible—the freedom to destroy freedom. The defender of liberty of thought and speech is not morally bound to enter the fight with both hands tied behind his back. And those who would deny such freedom to others, if they could, have no moral or logical basis for the claim to enjoy the freedom which they would deny . . .

"In the professional code of the scholar, the man of science, the teacher, the first commandment is: Thou shalt not knowingly misrepresent facts, nor tell lies to students or to the public. Those who not merely sometimes break this commandment, but repudiate any obligation to respect it, are obviously disqualified for membership in any body of investigators and teachers which maintains the elementary requirements of professional integrity.

"To say these things is not to say that the economic and even the political doctrines of communism should not be presented and freely discussed within academic walls. To treat them simply as 'dangerous thought,' with which students should not be permitted to have any contact, would give rise to a plausible suspicion that they are taboo because they would, if presented, be all too convincing; and out of that suspicion young Communists are bred. These doctrines, moreover, are historical facts; for better or worse, they play an immense part in the intellectual and political controversies of the present age. To deny to students means of learning accurately what they are, and of reaching informed judgments about them, would be to fail in one of the major pedagogic obligations of a university—to enable students to understand the world in which they will live, and to take an intelligent part in its affairs . . ."

IF EVERY COMMUNIST admitted he belonged to the party—or if the public, including college teachers and administrators, somehow had access to party membership lists—such a policy might not be difficult to apply. In practice, of course, such is not the case. A two-pronged danger may result: (1) we may not "spot" all Communists, and (2) unless we are very careful, we may do serious injustice to persons who are not Communists at all.

What, for example, constitutes proof of Communist Party membership? Does refusal to take a loyalty oath? (Many *non*-Communists, as a matter of principle, have declined to subscribe to "discriminatory" oaths—oaths required of one group in society, *e.g.*, teachers, but not of others.) Does invoking the Fifth Amendment? Of some 200 dismissals from college and university faculties in the past fifteen years, where communism was an issue, according to AAUP records, most were on grounds such as these. Only a handful of teachers were incontrovertibly proved, either by their own admission or by other hard evidence, to be Communist Party members.

Instead of relying on less-than-conclusive evidence of party membership, say some observers, we would be wiser—and the results would be surer—if we were to decide each case by determining whether the teacher has in fact violated his trust. Has he been intellectually dishonest? Has he misstated facts? Has he published a distorted bibliography? Has he preached a party line in his classroom? By such a determination we would be able to bar the practicing Communist from our campuses, along with all others guilty of academic dishonesty or charlatanry.

How can the facts be established?

As one who holds a position of unusual trust, say most educators (including the teachers' own organization, the AAUP), the teacher has a special obligation: if responsible persons make serious charges against his professional integrity or his intellectual honesty, he should be willing to submit to examination by his colleagues. If his answers to the charges are unsatisfactory—evasive, or not in accord with evidence—formal charges should be brought against him and an academic hearing, conducted according to due process, should be held. Thus, say many close observers of the academic scene, society can be sure that justice is done—both to itself and to the accused.

Is the college teacher's freedom in any real jeopardy?

HOW FREE is the college teacher today? What are his prospects for tomorrow? Either here or on the horizon, are there any serious threats to his freedom, besides those threats to the freedom of us all?

Any reader of history knows that it is wise to adopt the view that freedom is *always* in jeopardy. With such a view, one is likely to maintain safeguards. Without safeguards, freedom is sure to be eroded and soon lost.

So it is with the special freedom of the college teacher—the freedom of ideas on which our civilization banks so much.

Periodically, this freedom is buffeted heavily. In part of the past decade, the weather was particularly stormy. College teachers were singled out for

Are matters of academic freedom easy Try handling some of these

You are a college president.

Your college is your life. You have thrown every talent you possess into its development. No use being modest about it: your achievements have been great.

The faculty has been strengthened immeasurably. The student body has grown not only in size but in academic quality and aptitude. The campus itself—dormitories, laboratories, classroom buildings—would hardly be recognized by anyone who hasn't seen it since before you took over.

Your greatest ambition is yet to be realized: the construction of a new library. But at last it seems to be in sight. Its principal donor, a wealthy man whom you have cultivated for years, has only the technicalities—but what important technicalities!—to complete: assigning to the college a large block of securities which, when sold, will provide the necessary $3,000,000.

This afternoon, a newspaper reporter stopped you as you crossed the campus. "Is it true," he asked, "that John X, of your economics department, is about to appear on coast-to-coast television advocating deficit spending as a cornerstone of federal fiscal policy? I'd like to do an advance story about it, with your comments."

You were not sidestepping the question when you told the reporter you did not know. To tell the truth, you had never met John X, unless it had been for a moment or two of small-talk at a faculty tea. On a faculty numbering several hundred, there are bound to be many whom you know so slightly that you might not recognize them if they passed you on the street.

Deficit spending! Only last night, your wealthy library-donor held forth for two hours at the dinner table on the immorality of it. By the end of the evening, his words were almost choleric. He phoned this morning to apologize. "It's the one subject I get rabid about," he said. "Thank heavens you're not teaching that sort of thing on *your* campus."

You had your secretary discreetly check: John X's telecast is scheduled for next week. It will be at least two months before you get those library funds. There is John X's extension number, and there is the telephone. And there are your lifetime's dreams.

Should you . . .?

You are a university scientist.

You are deeply involved in highly complex research. Not only the equipment you use, but also the laboratory assistance you require, is expensive. The cost is far more than the budget of your university department could afford to pay.

So, like many of your colleagues, you depend upon a governmental agency for most of your financial support. Its research grants and contracts make your work possible.

But now, as a result of your studies and experiments, you have come to a conclusion that is diametrically opposite to that which forms the official policy of the agency that finances you—a policy that potentially affects the welfare of every citizen.

You have outlined, and documented, your conclusion forcefully, in confidential memoranda. Responsible officials believe you are mistaken; you are certain you are not. The disagreement is profound. Clearly the government will not accept your view. Yet you are convinced that it is so vital to your country's welfare that you should not keep it to yourself.

You are a man of more than one heavy responsibility, and you feel them keenly. You are, of course, responsible to your university. You have a responsibility to your colleagues, many of whose work is financed similarly to yours. You are, naturally, responsible to your country. You bear the responsibility of a teacher, who is expected to hold back no knowledge from his students. You have a responsibility to your own career. And you feel a responsibility to the people you see on the street, whom you know your knowledge affects.

Loyalties, conscience, lifetime financial considerations: your dilemma has many horns.

Should you . . .?

You are a business man.

You make toothpaste. It is good toothpaste. You maintain a research department, at considerable expense, to keep it that way.

A disturbing rumor reached you this morning. Actually, it's more than a rumor; you could class it as a well-founded report. The dental school of a famous university is about to publish the results of a study of toothpastes. And, if your informant had the facts straight, it can do nothing but harm to your current selling campaign.

You know the dean of the dental school quite well. Your company, as part of its policy of supporting good works in dental science, has been a regular and substantial contributor to the school's development fund.

It's not as if you were thinking of suppressing anything; your record

to solve? problems.

of turning out a good product—the best you know—is ample proof of that. But if that report were to come out now, in the midst of your campaign, it could be ruinous. A few months from now, and no harm would be done.

Would there be anything wrong if you . . .?

Your daughter is at State.

You're proud of her; first in her class at high school; pretty girl; popular; extraordinarily sensible, in spite of having lots of things to turn her head.

It was hard to send her off to the university last fall. She had never been away from the family for more than a day or two at a time. But you had to cut the apron-strings. And no experience is a better teacher than going away to college.

You got a letter from her this morning. Chatty, breezy, a bit sassy in a delightful way. You smiled as you read her youthful jargon. She delights in using it on you, because she remembers how you grimaced in mock horror whenever you heard it around the house.

Even so, you turned cold when you came to the paragraph about the sociology class. The so-called scientific survey that the professor had made of the sexual behavior of teen-agers. This is the sort of thing Margie is being taught at State? You're no prude, but . . . You know a member of the education committee of the state legislature. Should you . . .? And on the coffee table is the letter that came yesterday from the fund-raising office at State; you were planning to write a modest check tonight. To support more sociology professors and their scientific surveys? Should you . . .?

special criticism if they did not conform to popular patterns of thought. They, and often they alone, were required to take oaths of loyalty—as if teachers, somehow, were uniquely suspect.

There was widespread misunderstanding of the teacher's role, as defined by one university president:

"It is inconceivable . . . that there can exist a true community of scholars without a diversity of views and an atmosphere conducive to their expression . . . To have a diversity of views, it is essential that we as individuals be willing to extend to our colleagues, to our students, and to members of the community the privilege of presenting opinions which may, in fact, be in sharp conflict with those which we espouse. To have an atmosphere of freedom, it is essential that we accord to such diverse views the same respect, the same attentive consideration, that we grant to those who express opinions with which we are in basic agreement."

THE STORM of the '50's was nationwide. It was felt on every campus. Today's storms are local; some campuses measure the threat to their teachers' freedom at hurricane force, while others feel hardly a breeze.

Hence, the present—relatively calm—is a good time for assessing the values of academic freedom, and for appreciating them. The future is certain to bring more threats, and the understanding that we can build today may stand us in good stead, then.

What is the likely nature of tomorrow's threats?

"It is my sincere impression that the faculties of our universities have never enjoyed a greater latitude of intellectual freedom than they do today," says the president of an institution noted for its high standards of scholarship and freedom. "But this is a judgment relative only to the past.

"The search for truth has no ending. The need to seek truth for its own sake must constantly be defended. Again and again we shall have to insist upon the right to express unorthodox views reached through honest and competent study.

"Today the physical sciences offer safe ground for speculation. We appear to have made our peace with biology, even with the rather appalling implications of modern genetics.

"Now it is the social sciences that have entered the arena. These are young sciences, and they are difficult. But the issues involved—the positions taken with respect to such matters as economic growth, the tax structure, deficit financing, the laws

affecting labor and management, automation, social welfare, or foreign aid—are of enormous consequence to all the people of this country. If the critics of our universities feel strongly on these questions, it is because rightly or wrongly they have identified particular solutions uniquely with the future prosperity of our democracy. All else must then be heresy."

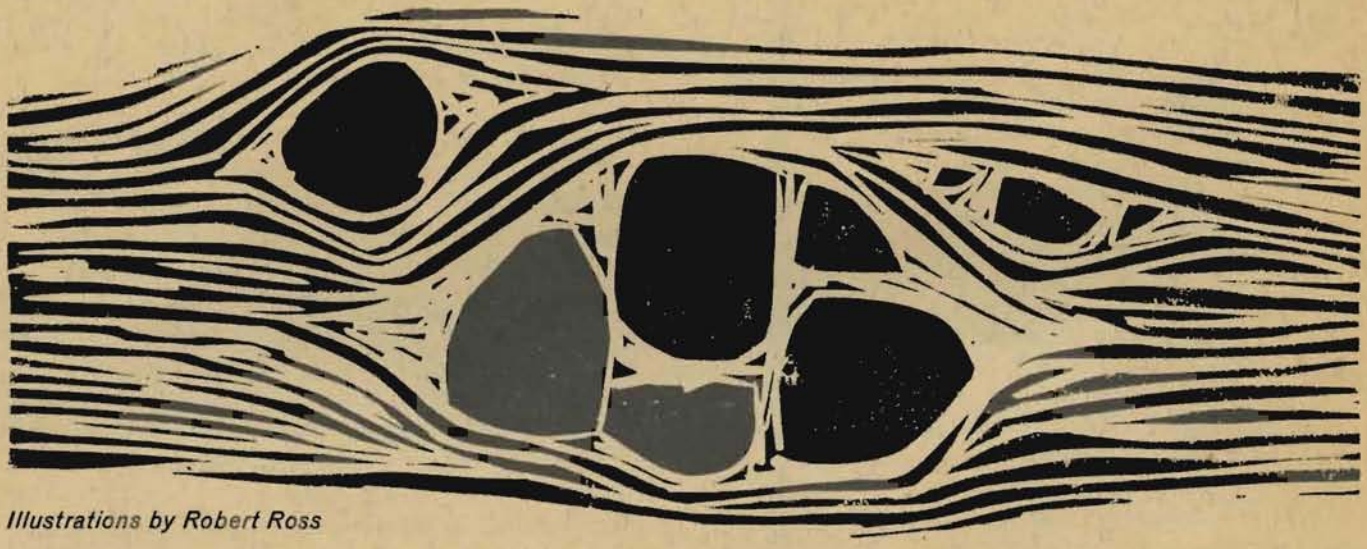
Opposition to such "heresy"—and hence to academic freedom—is certain to come.

IN THE FUTURE, as at present, the concept of academic freedom will be far from uncomplicated. Applying its principles in specific cases rarely will be easy. Almost never will the facts be all white or all black; rather, the picture that they form is more likely to be painted in tones of gray.

To forget this, in one's haste to judge the rightness or wrongness of a case, will be to expose oneself to the danger of acting injudiciously—and of committing injustice.

The subtleties and complexities found in the gray areas will be endless. Even the scope of academic freedom will be involved. Should its privileges, for example, apply only to faculty members? Or should they extend to students, as well? Should students, as well as faculty members, be free to invite controversial outsiders to the campus to address them? And so on and on.

The educated alumnus and alumna, faced with specific issues involving academic freedom, may well ponder these and other questions in years to come. Legislators, regents, trustees, college administrators, students, and faculty members will be pondering them, also. They will look to the alumnus and alumna for understanding and—if the cause be just—for support. Let no reader underestimate the difficulty—or the importance—of his role.



Illustrations by Robert Ross

"What Right Has This Man?"

The report on this and the preceding 15 pages is the product of a cooperative endeavor in which scores of schools, colleges, and universities are taking part. It was prepared under the direction of the group listed below, who form EDITORIAL PROJECTS FOR EDUCATION, a non-profit organization associated with the American Alumni Council.

SCIENCE AND THE AMERICAN DREAM

Continued from Page 19

ter. Yet I am very glad to specify two things where you are, without the slightest question, doing an incomparable service to the world, and about which you seem to us to congratulate yourself nothing like enough. These things are both symbolized by the university and made actual here.

One of the things of which you really should be proud is your college education. I haven't time to say very much about it, except that I regard it with both envy and admiration. You were the first people in the world to bring higher education to an enormous slice of an enormous country and to remove it from the privilege of the small elite. The only other country I can think of which only partially started to do this was, oddly enough, Scotland. Your country, however, did it on a very big scale without any encouragement from the rest of the world and with a great deal of discouragement from superior Englishmen. You are now reaping the rewards. The process has, as we all know, sometimes been wasteful, but it has been a generous waste. If we are going to make mistakes about human possibilities, for God's sake, let's make them on the generous side. You have done this, and I am certain you are going to be paid time and time again. I have certain qualifications about your high school education, if I may say so. I don't think in actual technical quality it is anything like as good as your higher education, although the spirit behind it is a very good one. But I have no doubt whatever that right over the whole width and breadth of America, college education is one of the real achievements of this world. I have heard that some colleges and universities are in fact below standard. That might well be so. It seems to me, since you are doing it in such a lavish way, it is likely to be so. All I can say is that I have seen more of your university institutions than most Englishmen and I have not yet met a bad one.

I am going to tell you a story which I think will surprise you. Last week the Soviet Ambassador at the Court of St. James was addressing a meeting at my old university of Cambridge. At question time, an African student rose to ask a perfectly innocuous question, which was intended to be something of this type: "Does not the Ambassador think that the general ignorance in America of the development of some African states will have undesirable qualities?" But the African was speaking in very slow and careful Nigerian English and so he only got as far as, "Does not the Ambassador think that the general ignorance in America . . ." when he was interrupted by happy laughter from the assembled young Englishmen. At that the Ambassador, who is a man of impressive personal authority, got to his feet and delivered himself like this: "I cannot listen to such laughter, which does no credit either to your intelligence or your information. My country has many points of difference with the United States but theirs is a great country. We have much respect for many of their achievements. We have particular respect for their achievements in the field of higher education. They have made themselves a highly educated country." Now that is a tribute from the only other country besides your own which has really, in a literal sense, put itself to school. I am sure it was meant just as it was said, and I hope it made the young men feel very sorry for themselves.

THE SECOND OF YOUR achievements on which I think you can congratulate yourselves nothing like enough is your work in pure science. You never say much to foreigners about it; I doubt whether you say much to yourselves. You are fond of pretending to be highly factual people; occasionally I have my doubts. But it is non-controversial that some of your greatest triumphs have been in the field of scientific imagination. This is not a matter of yesterday. It started much earlier. "Who was Willard Gibbs?" I have often asked young American intellectuals. Almost invariably they don't know. Yet it is highly arguable that Willard Gibbs was the greatest original creative mind ever born on these shores; and he was working in his hermit-like way at New Haven getting on to a hundred years ago. You know the old crack that Willard Gibbs discovered the whole of physical chemistry, but since he wrote in such an impenetrable way, it is probably easier to discover it again for yourself.

SCIENCE AND THE AMERICAN DREAM

Now the scientific achievement of the United States is moving at a rate that we all ought to marvel at. Just think of the astonishing constellation of ability, particularly in the physical sciences, down the Pacific Coast from Berkeley and Stanford to Pasadena and Los Angeles. There is nothing like that concentration of talent anywhere else in the entire world. It sometimes surprises Europeans to realize how much of the pure scientific research of the western world is being done here in the United States. The figure is probably something like 80 per cent, and it may be much higher.

This is one of your greatest gifts to all of us. Since success breeds success, the young men from our country, and to a lesser extent from Europe, are coming over here to take part. Science has always been an international activity from the time of its major flowering. If it ceases to be international, then it is nothing. Our only recourse is to make efforts comparable to yours in some fields where we can get your young men coming over to us.

ALL THIS, I THINK, can possibly be linked to the American dream, which to a foreigner doesn't and can't mean anything exact, but carries a sense of limitless possibility both for society as a whole and for the individuals within it. Let's not worry that in detail some of this dream doesn't make sense. It's a good dream. Most countries have nightmares. You were very lucky, of course. You had the free run of an enormous country and a mighty rich one. You had enormous luck, perhaps more than many of us thought, in the great belt of black earth on which I suppose we are standing now, which is larger than anything else in Europe or Asia. But above all, some of the reasons why the dream came true—and it has come true to a large extent—came from the supreme use you made of applied science. That is, in the industrial revolution you used applied science quicker than anyone in the world to make large numbers of articles, and in the scientific revolution which has been going on for the last thirty years you have made goods on a scale no one has ever made them before. Without this, the American dream—so far as it has been realized—wouldn't have been possible.

Now I always get into trouble when I say these brutal things. I get into particular trouble when I say that industrialization has on the whole been an enormous benefit to mankind. I feel a bit like General de Gaulle, who remarks that when he says Britain is an island everyone sits back as though this is the most startling and outrageous thing ever said. Similarly, when I say on the whole it is not good for people to live half-starved, suffer bad health, and die at twenty-five; and when I say this has been the common fate of man until quite recently and is so today in over half the world; and further, when I say the only way to avoid this fate is by industrialization and the use of applied science, I am regarded as sort of a demon-king. Yet this is a statement of the obvious at a time when it is less than human not to state the obvious. For the major social task of the next two generations—our children's and grandchildren's—is to see that half of our brother men don't live half-starved and die before their time.

We are now beginning to know what the brute facts of life were in pre-industrial France and England, in the early eighteenth century two of the most advanced countries in the world. This is being done by most painstaking and exhaustive researches into parish registers. This work was started in France and it is now being carried on also in England. Parish registers, remember, are the one record of how most of our ancestors lived. They are the only record of the poor. Almost the only thing the overwhelming number of our ancestors left behind them are three notes in the Church: one when they were born, one when they were married, and one when they died. These studies have borne out what anyone of realistic imagination has known for long, but it is very valuable to know in detail. I'll quote just one finding in all its harsh and horrifying eloquence. The eloquence is, perhaps, the more horrifying because it is couched in sociological jargon. In the parishes of England so far studied, a generation or two before the industrial revolution, the median age of marriage was higher than the median age of death. This means, being translated, that most people died before they got married. Most people, the majority of the population, did not get married at all. They had died first. Just think what this means in human terms. This was your pre-industrial Elysium.

Here in this lucky country you have pure science racing ahead and at the same time, over most of it, though not quite all, you are making astonishing use of applied science.

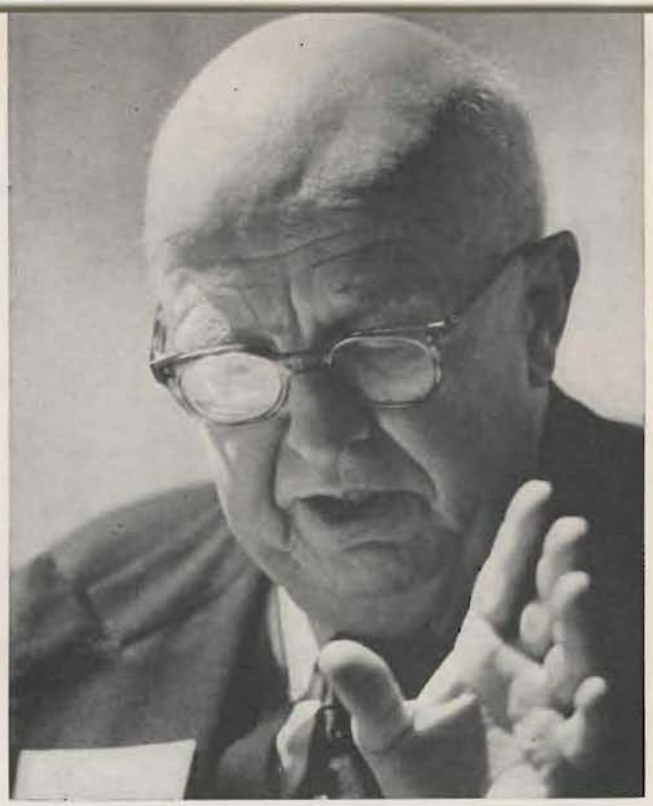
Just one side comment: It looks as though you feel now that certain parts of applied science can be left to themselves. It puzzles me and it puzzles lots of your friends that the number of engineers you are training each year is going steadily and quite rapidly down. Ten years ago you were training at college level about 60,000 engineers

a year. You are now training 40,000 engineers a year. This is a very surprising drop, because the comparable Russian figures are about 130,000 a year. I suppose one partial reason is that some of your fundamental engineering is largely complete and you don't need the maximum numbers. But even so, it seems to be an odd fact and one which we all ought to be just faintly concerned about. However, that's a triviality—on the whole things are going pretty well.

Now something else is going to happen. Something of such potential importance that one has to guard one's language. Something which is likely to affect us all. It will start, in fact it is already well started, in pure science. We may be on the edge of one of the great leaps in scientific history. If it happens, this leap is going to affect us much more intimately than the great leap in physics early this century. We may be just on the threshold of something which may touch us all where we live.

FOR THE LAST TEN OR TWENTY YEARS, there has been a kind of scientific underground movement all over the world. A whole new branch of science has been growing into something like active fulfillment. There is no real name for this branch of science, but "molecular biology" will do as well as any other. This movement has been bubbling out all over the world. One of its signs, though not the only one, is that you can use the extraordinary new skills in physics to take you somewhere near the center of the fundamental phenomena of what we call life. I ought to say that most professionals in this field are always very hesitant about using the words "life" or "living things" or any such terms. I think they get on much faster and further if they don't trap themselves with words, particularly with emotionally charged words.

These kinds of advances seem now to be trembling on the edge and they have been happening everywhere. They have been happening here at Washington University. The beautiful work which Dr. Commoner and Dr. Pake and their colleagues have been doing on free radicals is a very exact sign of what I am thinking of. Elsewhere people have been working out what the nucleic acids are. They sound strange but they are substances which are at the root of life as we know it. And there are other kinds of attack. None of us knows which is going to take us deepest. It is possible that the problems are more intractable than they look at present. But the general consensus of informed opinion is that probably we shall be very deep in quite soon—quite possibly within ten years. It's not melodramatic to say that we may be in the first days of a biological revolution.



I should like to say a few words about one part of this work which I happen to know intimately, simply because I had friends who were in it at the beginning. You have all heard, at least I hope you have all heard (if you haven't, I've lived in vain) of crystallography, which tells you how atoms are arranged in molecules. The application of this method to the fundamentally important biological molecules happened first in England. We are very proud of that and I don't think our American colleagues will grudge us the pleasure of it. Don't write us off completely yet awhile. We are still capable of pulling a few things out of the bag. You may have noticed that in 1962 Francis Crick, who is an Englishman, and James Watson, who is an American, together with another Englishman, Wilkinson, were given a Nobel Prize for their working out the structure of DNA, which is the substance that conveys the genetic information which tells ourselves how to grow. This collaboration is one of the most fascinating in history. Crick and Watson each had one half of the story and they came together and finished their side of the work in about three weeks. This was done by a very curious method, because Crick, unlike Englishmen in fiction, is not particularly silent; in fact, he talks almost the entire time. He gives his recreation in *Who's Who* as "conversationalist, especially to pretty women." This is broadly true. On the other hand, I think no one could call Watson conversational. How they actually made the communication I've always wondered. There are various accounts. One has Watson going off when he thought Crick had talked long enough and writing a short note saying "This is nonsense." But yet they have done something which certainly has set a new line of advance for us all. Crick has now gone further and told us something about what the genetic code is like—what bits of these strange complicated molecules tell, what bits of them change as they give that informa-

tion to the living cell. This is more speculative, but upon this work much of our future information about heredity will most certainly be built. These men are all quite young. Their work was built, on the other hand, on older English people like Bernal and Bragg, both men of genius thirty years ago. I can still remember seeing, just about thirty years ago, the first x-ray photographs of protein molecules in Bernal's laboratory at Cambridge; so you must forgive me my nostalgia. Now this work and the whole of the related field, which is only one side of it, is being taken up with all the generosity and resources and optimism of the United States. It is taking root everywhere. This is the scientific fashion.

You may have heard of the Jonas Salk Institute out at San Diego. Salk has deliberately set himself to give anyone who is interested in anything of this kind the chance to use his talents with every facility and resource that American riches and American free-mindedness can give. I am not interested in this just because I happen to be a trustee of this Institute, but simply because I have had the privilege of Salk's friendship for a good many years and he thinks I'm a sensible old beast. But I'd be more than disappointed—I'd be surprised—if out at San Diego we don't get some illuminations that will justify all the imagination that Salk and his friends put in.

So here we are on the fringe of what may be a major leap in science. There have been several major leaps—Copernicus, Newton, Darwin, Einstein, Rutherford, Bohr. No one would claim that this has the same scientific conception or originality so far, but yet it may touch us more deeply. I think it is very important that we should not be emotionally or intellectually unprepared. If we are not prepared emotionally and intellectually, it is going to produce grave disquiet on the human level. And there is an incidental advantage that a lot of the scientific reasoning in this particular kind of advance is not so difficult as the advance in physics a generation ago. This can be comprehended by intelligent people who will stretch their minds.

Let me indicate very vaguely, and I'm being deliberately vague because I don't want to raise hopes and then disappoint you, or alternatively to suggest fears that may be exaggerated, but I said that the American dream contains a sense of limitless possibilities for the individual human being. Well, all sensible people know that in fact that is not true; that human beings in certain respects are limited. If I had spent my entire life doing nothing else but training myself to run the mile in four minutes, I should not have had a particularly useful career. In the same way, if most of us had spent our lives training ourselves to do certain kinds of pure mathematics, we shouldn't have gotten further than first base. There are limits which we all know, partly by instinct, partly by the hard rub of life, but, so far we have been able to forget it, or at least think that it may be not too serious and perhaps the result of chance or environment. In the near future, we may see these limits spelled out in terms of scientific fact. This, it seems to me, is going to be something of a moral shock. It is going to take great judgment and fellow feeling to reconcile such a new kind of knowledge to a desirable human life. We may have to know that we all have our limits and what these limits are. Some of these limits may be more confining to live with than others that we have all come to terms with. I am sure we have got to be more or less prepared for this, not so much for ourselves, because we know something about ourselves, but for people all over the world and for our children. In the light of what may be coming upon us, it may be passionately necessary to stand by the position that, whatever the limits which vary from person to person, in an ultimate sense we are each of equal value. All statements to the contrary have to be denied all along the way. I am quite sure that a moral standpoint about the equal value of the human individual may be more important in the light of what science is going to tell us fairly soon than it has ever been in our history. That is one of the obvious consequences. There are going to be others. There are going to be obvious medical results, some benevolent, some not. There are going to be social results, again some benevolent and some not. But those I think we also must be prepared for. We have one advantage, and one advantage that we have never had before. Previously, any great leaps in science have come upon us unprepared. The atomic bomb came upon us quite unprepared in the middle of a war, and none of us was morally ready to cope with the thing when it happened. The same was true of the Darwinian revolution in the last century. This time we have no excuse if we are not ready.

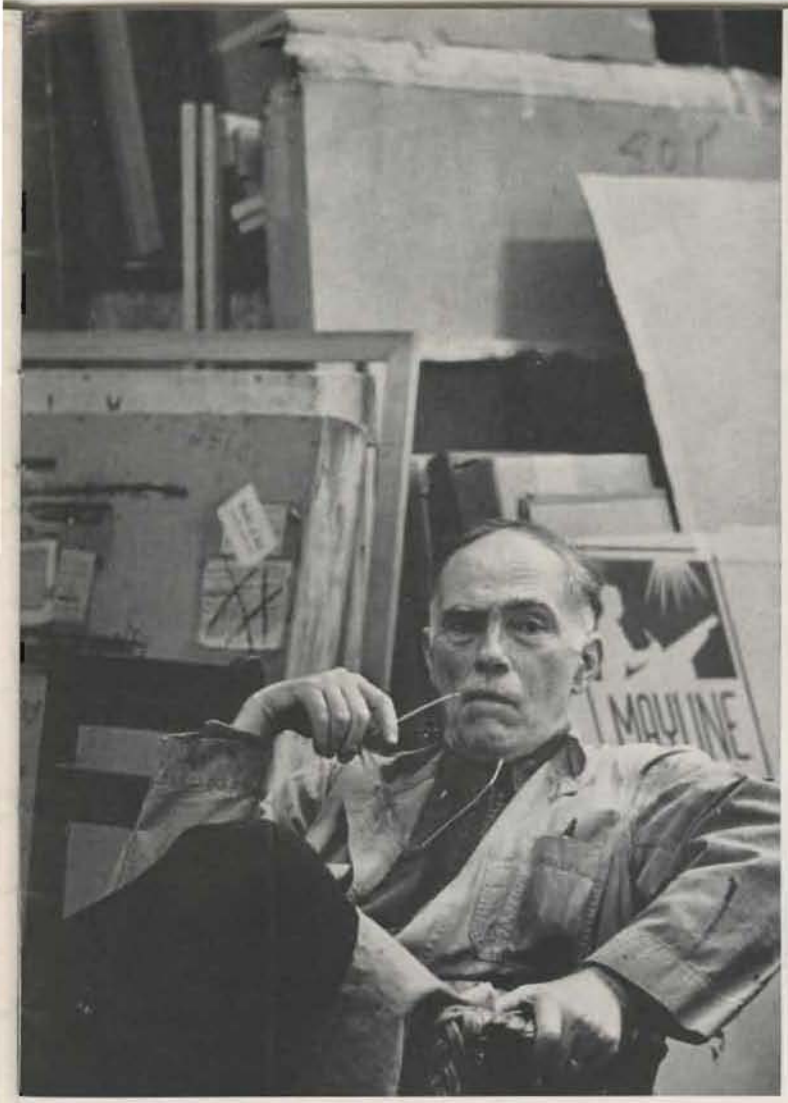
Now let me finish on a cheerful note. If this happens as some think it will happen, it will do us one great good. We have lived in an exciting world. The world of our time has been full of excitements, sometimes a few too many, but we have been rather short of intellectual excitement for forty years. We have been living on the disputes of the past. We have been refining things which have been thought out earlier this century. We have had nothing really new which might make us think of our own nature, of how we stand in the world, and of our ultimate human and social condition. We have had nothing new which has stimulated us about the fundamental problems of man's destiny. This, I think, will. It certainly may. In that case, it will be a marvelous good to the whole world.

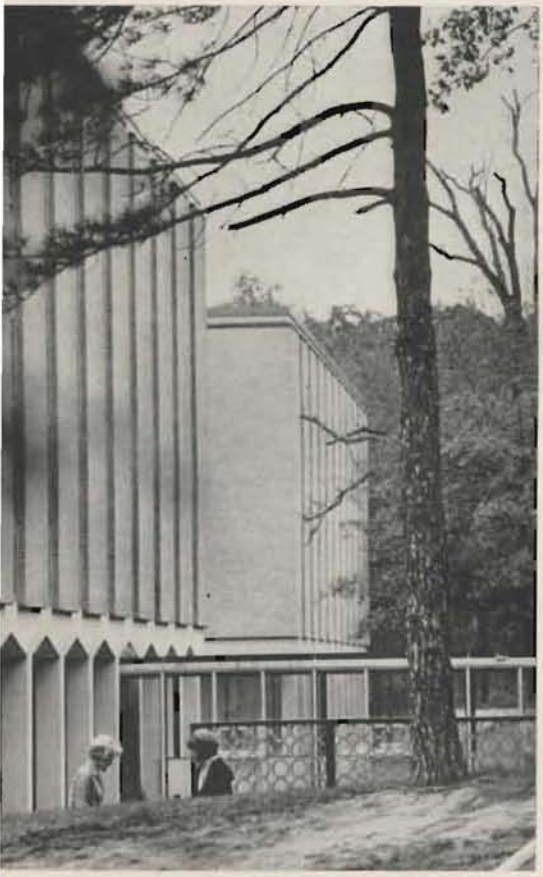
THE WORLD OF THE UNIVERSITY

An Exhibition of Photographs by Herb Weitman

FROM AMONG THE TENS of thousands of photographs Herb Weitman has taken during his 13 years as Washington University's photographer, some one hundred were displayed recently at a St. Louis Jewish community center. Called "The World of the University," the exhibition drew hundreds of visitors and received enthusiastic notices in the press. George McCue, art critic for the *St. Louis Post-Dispatch*, summed up best, perhaps, the special appeal of Weitman's work. In his review, McCue remarked,

"The significant fact about Weitman's photographs is that they constantly reflect, not just a collegiate environment, but the quality of life on a big campus. They search beneath the surface of casually dressed students and tweedy faculty members in a neo-Gothic setting for the concerns and reflections they share." Here are a few samples.






Michelle
Strickland
Group 5

In a Tyrrell Williams lecture at Washington University this spring, Supreme Court Justice William J. Brennan, Jr. urged that the prosecution be required to reveal its case to the defendant in criminal as well as civil cases. In these excerpts from his lecture, Justice Brennan presents his arguments for this view.

THE CRIMINAL PROSECUTION: *SPORTING EVENT OR QUEST FOR TRUTH?*

By WILLIAM J. BRENNAN, JR.

Associate Justice of the United States Supreme Court

THE QUEST FOR BETTER JUSTICE is a ceaseless quest. The single constant for our profession is the need for continuous examination and re-examination of our premises as to what law should do to achieve better justice. Should we extend to criminal prosecutions the civil pre-trial discovery techniques which force both sides of a civil law suit to put all cards on the table before trial, and tend to reduce the chance that surprise or maneuver, rather than truth, may determine the outcome of the trial? Or, as Glanville Williams asked recently, shall we continue to regard the criminal trial as "in the nature of a game or sporting contest" and not "a serious inquiry aiming to distinguish between guilt and innocence"?

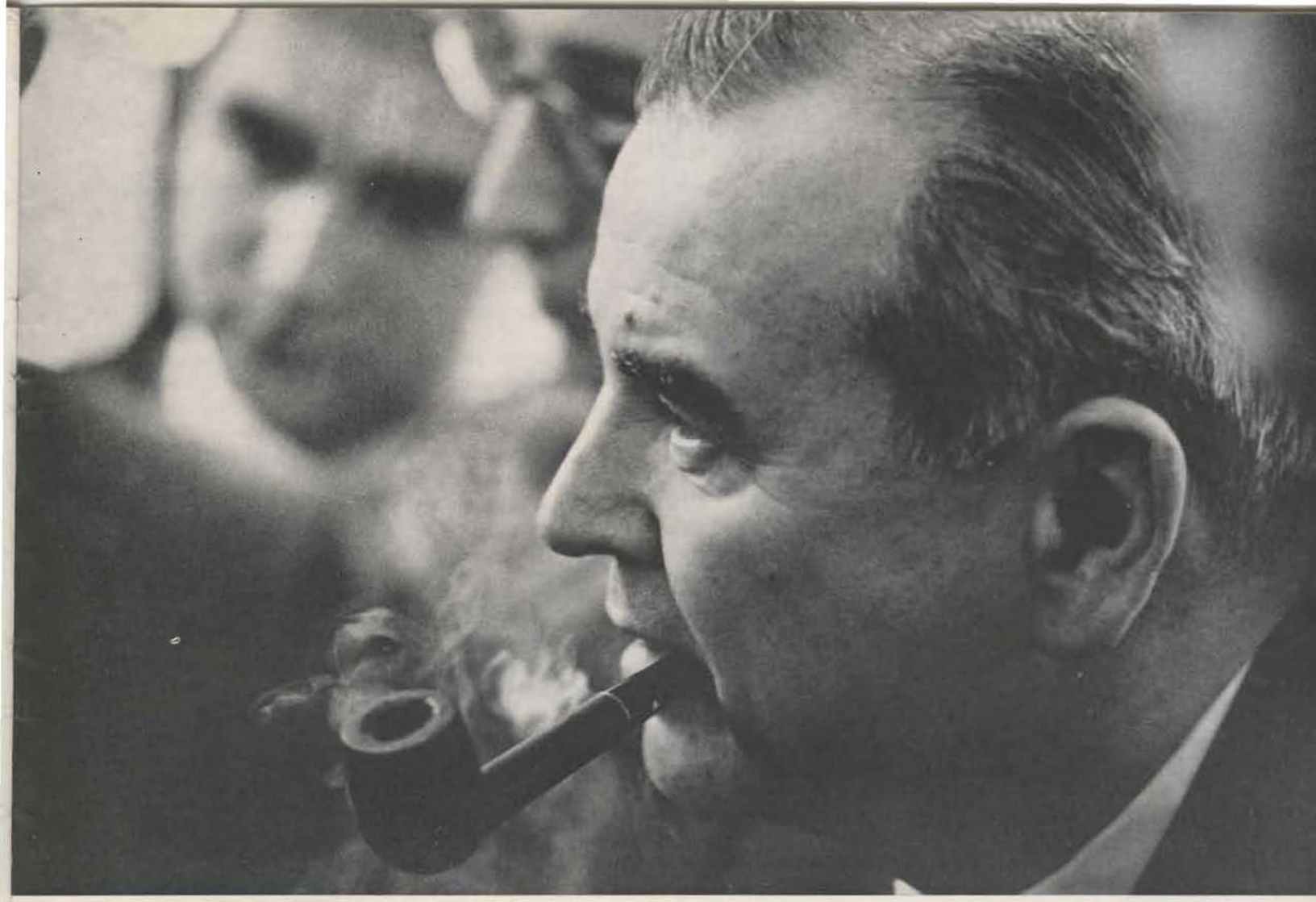
Before we get too deeply into that subject, one observation is appropriate, perhaps even necessary. My subject involves, of course, a question of criminal procedure—the process by which one accused of any crime has his guilt or innocence decided. Now it's a matter for real concern, I submit, that so many in our society, laymen and lawyers alike, show impatience with any and all procedures which appear to hamper the task of law enforcement agencies to bring an accused to conviction. More people than not resent the privilege against self-incrimination. Confessions extracted by prolonged interrogation of an accused may concern judges and criminologists, but trouble little the consciences of others. Police without a search or arrest warrant have broken down a suspect's door and provoked little public outcry, if perchance they stumbled on evidence which eventually proved his guilt. Too many of us seem to have forgotten the true office of the constitutional procedural safeguards against police tactics such as these. We have forgotten that these safeguards, while they do indeed make harder the conviction of an accused, were not provided for that purpose—the framers of the Constitution weren't "soft on criminals." These safeguards are checks upon government—to guarantee that government shall remain the servant and not the master.

Mr. Justice Douglas made the point from this podium four years ago that what distinguishes our criminal law from that of totalitarian regimes is really only this: that however desirable the ends, long and bloody history taught us that there are some police tactics that are not safely tolerated in a free society; in addition to the question whether our free society can morally tolerate them, such toleration could only end up in making government the oppressor of each and every one of us.

Few issues raise more sharply the basic ideological clash between opposed theories of criminal justice. Perhaps this is the reason for the bitterness that has often marked the debate. Until a few years ago American courts had virtually closed minds to any proposals for criminal discovery. As recently as 1927 Mr. Justice Cardozo was able to discern only "the beginnings or at least the glimmerings" of a "power in courts of criminal jurisdiction to compel the discovery of documents in furtherance of justice." *People ex rel. Lemon v. Supreme Court.*

Of course, I suspect that there has for some time been a very great deal of discovery in actual day to day administration of the criminal law. I mean by this that prosecutors have not been loathe to show their files to defense counsel—to some counsel because they trust them; more often, to any counsel, if disclosure offers the chance that council will persuade the client to enter a plea and save the prosecutor the trouble, and the state the expense, of a trial. Apart from the constitutional overtones of denial of equal protection involved in such a practice, I think we must all agree that the opportunity for discovery on equal terms should either be the right of all accused, or the right of none.

It may appear strange that resistance to criminal discovery should be so stubborn in America, when Chief Justice Marshall seemed so strongly to approve it. You will recall that as a Circuit Justice he presided in the celebrated trial of Aaron Burr. At that trial a request was



made on Burr's behalf for pre-trial inspection of a letter addressed to the President of the United States and in the possession of the United States Attorney. Although the great Chief Justice did not hold that there was an absolute right to compel disclosure, in characteristically strong terms he stated his view that if the letter had evidentiary relevance, or indeed was useful in cross-examination of any Government witness at the trial, it could not, in fairness to the defendant, be withheld from him. But the value of that precedent was virtually unappreciated in our country for almost a century and a half.

I submit that we must rethink our opposition to allowing the accused criminal discovery, certainly if we are to continue to maintain that our system of criminal justice, if not favoring the accused, at least keeps the scales evenly balanced in his contest with the state. Are the scales really evenly balanced? Who are our criminal defendants? Are they people having relatives with resources capable of helping in their defense? By and large, the so-called "white collar" criminal probably does have the resources and friends to aid him in his defense. Justice is indeed well served when prosecution and defense are fairly evenly matched. But is this the situation for the vast majority of our "blue collar" defendants? Judges know that most of these people are indigent.

To put it another way, these offenders, the largest number by far of the total of all offenders, come from that section of society where conditions result in the largest crime rate. It is here also that the mentally retarded are found—the experts make the provocative suggestion that deprived socio-economic upbringing causes considerably more retardation than organic or hereditary factors.

Do not these less privileged of our society present the particular problem that without resources to prepare a defense, they often don't have an adequate defense? Can we boast of a decent administration of the criminal law if we don't provide them some redress against this hard reality? Criminal discovery would be one tool whereby they would have a better chance to meet on more equal terms what the state, at its leisure and without real concern for expense, gathers to convict them.

And what of the task society puts on the shoulders of assigned counsel? For public defenders are still provided by only a few states, and the Federal Government is only beginning to work out such a plan; assigned counsel must perforce provide what legal representation these defendants receive. But we give assigned counsel not only no compensation for his services in most cases—we deny him both financial help to prepare a defense and the discovery, which if not the best, might at least provide a

substitute. Moreover, the court-appointed lawyer in a criminal case usually comes to the case late, after the state has gathered its evidence against the accused.

Assigned counsel therefore must do what he can within the limited time usually allowed him before trial, often long after the trial has grown cold. He must deal with an accused whose obvious interest in self-justification complicates his lawyer's task of finding the true facts. Even if he can learn the names of the witnesses against his client, those witnesses have already talked to the state's investigators and more frequently than not have been warned not to talk with anyone representing the accused. If his client has signed a confession he has added problems. In view of the practical realities of police interrogation, he travels a rough road if he would establish whether the confession was coerced, or fairly represents what his client told the officers. In all fairness, should he not at least be allowed a copy to see what there is about the confession which will permit him to pursue that inquiry before trial? And if some of the state's evidence is physical and tangible and has been subjected to police laboratory analysis or tests, the assigned counsel denied a look at the reports is at an obvious disadvantage.

Even if he can see the objects the police tested, he won't have the funds or the facilities to have tests of his own made. Not every accused has the good fortune to have an ingenious Perry Mason as his counsel.

What assigned counsel obviously needs to discharge the heavy responsibility we give him is at least the opportunity to do what the state does when the trial is fresh, namely, seek corroboration of the accused's story, or lack of it, from external facts through avenues of inquiry opened by what the state has learned. The implication in the argument against discovery is that the accused is guilty, so that not only may he not complain of the use against him even of his confession, or to its use as a source of leads to make the case against him as ironclad as possible, but that he really has no complaint that his counsel is denied access to the same materials to aid him better to develop the whole truth.

In other words, the state may eat its cake and have it too. To that degree, does not the denial of all discovery set aside the presumption of innocence—is not such denial blind to the superlatively important public interest in the acquittal of the innocent? To shackle counsel so that he cannot effectively seek out the truth and afford the accused the representation which is not his privilege but his absolute right seems seriously to imperil the bedrock presumption of innocence.

And might not expanded discovery benefit the prosecution as well as the accused? If sharpening of the issues, exposure of untenable arguments and more efficient marshaling of the evidence result from discovery, doesn't the prosecution profit? For if voluntary disclosure to defense counsel often results in guilty pleas because defense counsel becomes convinced of the hopelessness of the client's cause, should not a rule authorizing criminal discovery in every case result in even more dispositions without trial?

The beneficial results claimed for statutes of an increasing number of states, which require an accused to give the prosecution pre-trial notice of an alibi or insanity defense, include not only preventing surprise at the trial but also aiding more effective preparation for trial. What justifies our being so sure then that according criminal discovery to the accused will benefit only the accused at the expense of the state?

THE REASONS CITED against pre-trial discovery have a persuasive appeal. But are their merits so clear?

First is the reason that pre-trial discovery would inevitably result in a perjured defense. That objection, I say with all respect, is startlingly reminiscent of Sir John Wigram's reason expressed over a century ago when the struggle to introduce discovery in Chancery was so bitterly waged.

Said Sir John, "Experience . . . has shewn—or (at least) courts of justice in this country act upon the principle—that the possible mischiefs of surprise at the trial are more than counterbalanced by the danger of perjury, which must inevitably be incurred, when either party is permitted, *before* a trial, to know the precise evidence against which he has to contend. . . ." But, as has been trenchantly observed, "English courts never had any experience at all in the matter. . . ."

By the same token, how can we be so positive criminal discovery will produce perjured defenses when we have firmly shut the door to such discovery? That alleged experience is simply non-existent. So if it be true, as unfortunately it is, that crime is on the rise in this nation, we surely can't blame that regrettable fact on the operation of any criminal discovery procedures.

I must say I cannot be persuaded that the old hobgoblin perjury, invariably raised with every suggested change in procedure to make easier the discovery of the truth, supports the case against criminal discovery. I should think rather that its complete fallacy has been starkly exposed through the extensive and analogous experience in civil causes where liberal discovery has been allowed and perjury has not been fostered. Indeed, this experience has suggested that liberal discovery, far from abetting, actually deters perjury and fabrication. Surely that experience is solid evidence of the beneficial results of discovery to the cause of justice, without that defeat of justice through prejury foretold by the prophets of doom.

In any event, as has been said, "The true safeguard against perjury is not to refuse to permit any inquiry at all, for that will eliminate the true as well as the false, but the inquiry should be so conducted as to separate and distinguish the one from the other where both are present."

We must remember that society's interest is equally that the innocent shall not suffer and not alone that the guilty shall not escape. Discovery, basically a tool for truth, is the most effective device yet fashioned for the

reduction of the aspect of the adversary element to a minimum. Even Dean Wigmore, certainly no champion of leniency for the criminally accused, could find no merit in this objection that discovery would encourage perjury. Said he: "The possibility that a dishonest accused will misuse such an opportunity is no reason for committing the injustice of refusing the honest accused a fair means of clearing himself. That argument is outworn; it was the basis (and with equal logic) for the one-time refusal of the criminal law . . . to allow the accused to produce any witnesses at all."

The second argument is that an accused, knowing the names of witnesses against him, may see to it that they are silenced before the trial. Of course, there have been instances where this has happened. But no one suggests that discovery in criminal cases should be at large and without the intervention of judicial discretion. Surely, whether or not this is a danger in a particular case is a matter to which courts ought to give some consideration. Where that possibility may appear, a trial judge's discretion affords an ample safeguard. Dangers and other abuses of this kind are clearly a matter of legitimate concern—they argue however not for wholesale prohibition of criminal discovery but only for circumspection and for appropriate sanctions tailored to dealing with apprehended abuses in the particular case.

The third objection—that our constitutional privilege against self-incrimination prevents discovery being a two-way street—is admittedly more troublesome.

But is this premise really sound? Is the privilege against self-incrimination in fact a barrier to state discovery of the accused? The innumerable cases that come to our Court charging police abuses of the interrogation process suggest the contrary. The right to conduct prolonged questioning of suspects is vigorously championed by law enforcement authorities. Success very frequently crowns the effort, if the proportion of guilty pleas and convictions resting upon confessions affords a reliable guide.

And even apart from discovery of this sort, what of the investigatory paraphernalia important to the preparation of criminal evidence which is, as of course it should be, available to law officers? Laboratories, skilled investigators, experts in all areas are an essential part of the equipment of every agency which would boast of being abreast of the modern techniques for the detection and prevention of crime. All of us are gratified that our agencies are so equipped, and would not want to strip their resources. But I suggest that it overstates the fact to say that we don't need to extend criminal discovery procedures to the accused because the scales are already distorted in his favor by the privilege against self-incrimination and the fact that the state has the burden of proving his guilt beyond a reasonable doubt.

There is one final issue to which I might turn my attention for a moment. Assuming that, as I believe, we should adopt broader criminal discovery, should the definition of its limits be a matter for legislatures or courts? I incline to believe that just as discovery in civil causes is largely a matter of court rules, so also should be the fashioning of rules for criminal discovery. For one thing, most of the progress already made toward liberalizing criminal discovery has come from court decisions and court rules and not from legislative enactments. This is true even as to the limited discovery permitted under the Federal Rules of Criminal Procedure, and is so much the more true as to the states.

Two other reasons also suggest that judicial rather than legislative rulemaking is to be preferred. The extent to which discovery should be allowed in particular cases will present complex problems. There will be questions for the exercise of sound discretion depending upon the particular materials of which discovery is sought. The showing of need of a given accused may require discovery despite strong state interests advanced by the prosecution against allowing it. In other words, there will be much need for the striking of a proper balance in individual cases. Surely arguments of the prosecution that, for example, witnesses might be imperiled are not wholly illusory. And to the extent discovery of the accused may be sought by the prosecution, there will necessarily lurk below the surface constitutional questions arising from the privilege against self-incrimination.

IN SHORT, THESE ARE problems that argue not only for judicial discretion but perhaps, at most, for an even greater measure of discretion than has been found necessary in the area of civil discovery.

I do not deny the force of the objections which have been raised against expanding criminal discovery. All I have attempted to suggest is that these objections, if not wholly invalid, are simply not insurmountable. In any event, I have great difficulty accepting them as reasons for refusing to allow criminal discovery under appropriate safeguards. Where dangers do exist and abuses are threatened, not denial of discovery but appropriate safeguards to prevent such dangers and abuses should be our effort. We found out that the civil discovery procedures could be abused, and fashioned safeguards against them. The court-made rules protecting the attorney's work product and enforcing privileges against disclosures of confidential or secret information are examples.

If there is merit in the insistence that the public interest in law enforcement requires even stronger safeguards against unwarranted disclosure of the prosecution's case, surely appropriate sanctions can be devised. In the rare case the denial of all discovery may be compelled to protect the safety of witnesses or prevent an apparent perversion of the judicial process. So I would leave the primary responsibility with the trial judge under such guidance from appellate courts as may be necessary to mark its proper limits. The gain to the public interest in the pure and just administration of the criminal law is well worth the risks.

In search of the "missing link" between ferns and true seed plants, a team of scientists explored lonely Ellesmere Island, deep within the Arctic Circle.

By HENRY N. ANDREWS
Professor of Botany

Botany in Ellesmere Land

A CONSIDERABLE PART of the land surface within the Arctic circle is a barren wilderness of rock and it was in part this very barrenness that attracted us to Ellesmere Land. We hoped to find evidence in the rocks of the plants that lived there in bygone ages, for the northern islands have not always been the forbidding ground that has drawn so many rugged explorers to their last journey. For long periods of time, in fact over a span of at least 300 million years, forests have flourished under conditions that were very different from those of today; plants preserved in the rocks as fossils reveal the Arctic, prior to the recent Ice Age, as having had a much milder climate than at present. But large areas remain unexplored and more information is needed to fill out what is still a rather sketchy picture. As an introduction to our own venture it may be pertinent to mention a few of the fossil deposits that have shed light on the contrasting landscapes of the past and present.

Spitsbergen has yielded up an abundance of information about the plants that grew there in Tertiary times—dating back some 50 to 60 million years. Impressions of leaves and seeds indicate forests composed of maple, alder, birch, hazelnut, witch-hazel, Katsura-tree, and the dawn-redwood. An important source of information concerning the ancient forests now comes from studies of fossil pollens, and the Norwegian botanist Manum has recently added a notable chapter to the plant records for this Arctic archipelago; he has found pollen of several evergreens including fir, spruce, pine, larch, and the umbrella pine. The pollen record also indicates the former presence of numerous flowering plants, among them being members of the heath, sundew, and cat-tail families, as well as others that are not closely comparable with any living plants. It seems quite clear that the early Tertiary climate of Spitsbergen was a temperate one. (Some liberty is taken here with the use of common names; they should be regarded as being closely related but not necessarily identical with the living species.)

From Disco Island, midway along the west coast of Greenland, a fairly rich fossil flora has been found in rocks of Chalk Age, which are about twice as old as the Spitsbergen deposits mentioned above. It has not been possible to correlate all of the fossils from Disco Island with modern plants, as might be expected in view of the distant era in which they lived; however, the general relationships of many of them are evident. Ginkgo and several of its relatives occurred in some abundance. The conifers were rather well represented and it is of interest to find that the flora included both evergreen and deciduous trees. There were several ferns including the lovely gleichenias, which are widely distributed today in the tropics and near-tropics; among the flowering plants there are members of the oak, magnolia, laurel, sycamore, and legume families.

The most exciting of all, and perhaps the most discussed fossil plant ever to have come out of the Arctic, is a fine leaf and fruit that compares closely with the living tropical breadfruit. This is something of an enigma and has been the focal point of considerable discussion about the climate of that area during the Cretaceous; the sum total of the evidence indicates that it quite certainly was more hospitable than it is now but was probably temperate rather than tropical.

Going back even further in time, to the early part of the Jurassic period (about 150 million years ago), and over on the east side of Greenland, one of the most prolific fossil floras ever discovered anywhere has revealed a wealth of plant life.

A few years ago Professor Harris of Reading University in England spent a year there, in the vicinity of Scoresby Sound which lies at about 70° north latitude, and his collections have added a great chapter to our understanding of Arctic forests of the past. The results of his studies appeared in five volumes and it is hardly possible to sum them up in a few lines, but a few of the highlights give some idea of the richness of the ancient flora. There were many cinnamon-fern relatives—so abundant today along the roadsides of our eastern states—as well as gleichenias and tropical marattias, and several other fern families that are confined now to southeastern Asia. There were numerous cycads and cycad-like plants, an abundance of ginkgo relatives, and, most interesting of all, many fossils

Courtesy, *Missouri Botanical Garden Bulletin*

Object of the quest: *Archaeopteris*, a fossil plant found in rocks 300 million years old and forming the bridge between ferns and true seed plants.

Impressions of the trunks of an ancient forest cover a rock wall in Ellesmere Land. In background, only a few yards away, is the Arctic icecap.

that cannot be compared closely with any living plants.

If one could slip back 150 million years into the past and wander through these forests, of what is now the east Greenland coast, there would be both friends and strangers, but regardless of how many could be recognized, it would be a very different landscape from the present one.

Investigations such as those outlined have given us the knowledge we have of the vegetation and climate of the Arctic in the past. But many of the collections of fossil plants that have been made to date have been acquired more or less incidentally to the main objectives of the particular expedition. In view of the vastness of the country there is a strong likelihood that a concerted search, or rather, many searches, would be apt to turn up new plants in previously unexplored deposits.

Ellesmere Island is a large chunk of land and few paleobotanists have visited it. We thus set out with several objectives: We wanted to find out more about any and all plants that lived there in former ages. We were especially hopeful of finding a particular fern-like plant, *Archaeopteris*, as a source of information bearing on the origin of early seed plants. One of our party, an expert on Canadian peat deposits, wished to investigate peat formation in high latitudes; and finally, it may be confessed, we wanted to see the Arctic!

Our small expedition of three left Winnepeg early one morning toward the latter part of June and landed a few hours later at Churchill, on the west shore of Hudson Bay. Several days later, with our three-quarters of a ton of baggage assembled, we took off in a Canadian Air Force plane for Resolute Bay another five hours to the north. We had arranged with a commercial company to meet us there with a DeHaviland "Otter," capable of carrying about a ton including passengers and baggage. After a meal, and with our baggage transferred, we took off again on the final lap of our journey, to the head of Goose Fiord.

Transportation in the Arctic is still a difficult problem but today it is largely by air; with some luck and a good deal of money it is possible to get places in a few hours or days that required months or years a few decades ago. I was delegated to ride in the cockpit with the pilot and select the landing site at our destination. During the two previous flights the vegetation had been gradually becoming more stunted until it disappeared almost completely. Aside from the change in the vegetation the most impressive feature of the north country is the endless number of lakes; at almost any point from Winnipeg to Resolute there are thousands of them in view from the air, of all sizes and shapes.

The complete barrenness of the country for the first hour out of Resolute was depressing; the low-lying brown earth with hardly a vestige of plant life strikes no joy in the heart of a botanist. But as we approached the southwest coast of Ellesmere, the abrupt headlands and snowcaps on the plateau country marked a scenic change for the better.

Goose Fiord is a narrow band of water extending inland for 20 miles with sides that are quite steep in places, and rising as high as about 1500 feet. At the head of the fiord the land is comparatively level with, as we found later, a meager but lovely flora, where dwelled a fine herd of caribou. I motioned to the pilot toward what appeared to be an acceptable campsite central to the rock exposures we wished to investigate. He swooped once over the area, picked out a stretch of a few hundred yards that was reasonably free of large rocks, and down we went—to a successful landing.

After a day spent in establishing a camp and exploring its immediate surroundings, we set to work in earnest to search for the ancient fern-like plants that had lived here some 300 million years ago. Our "leads" were two-fold: we had some knowledge of the geologic age of the rocks and, in 1902, a Norwegian expedition had spent some time on this part of Ellesmere and had found a few specimens. Aided by a rough sketch map of the north end of the fiord we set about locating the spots where they had found fossils some 60 years before.

This part of Ellesmere does not conform with the concept of the Arctic as a land of perpetual snow. We were, however, welcomed with a few days of weather that was something short of tropical. On the second day sleeting rain descended as we ate lunch on a high rocky slope, and the following day and a half we remained in the tents hoping that the extra weight would help keep them from blowing away in the gale that poured down from the snow field a few miles to the east. But for most of the next month the sky was cloudless with the sun making a great circle overhead every 24 hours. The temperature ranged from 45 to 55° F. most of the time and a few days were uncomfortably warm for us with heavy packs on our backs.

On windswept Ellesmere, Dr. Andrews makes notes. Also on trip were Drs. T. L. Phillips of the University of Illinois and N. W. Radforth of McMaster University in Canada.

BOTANY IN ELLESMERE LAND

In late June the fiord was still frozen, with great masses of sea ice piled up on the shore and a few seals sunning themselves on ice cakes a short distance out; but with two weeks of steady sun it was transformed into a sheet of brilliant blue water. Most of the country within a radius of seven or eight miles of our camp was free of snow by mid-July—a rocky, barren land, with the exception of the valley immediately to the north, which was carpeted with a rather lush growth of grasses, sedges, and moss.

On the several trips we made in that direction we always encountered the caribou and, with some patience on our part, they would come up to within fifty yards of our cameras. The lone musk ox that we found one day was less curious of the two-footed invaders and we followed him for an hour, finally using a low hillock as a shield to approach close enough for a photo. In a ravine near our camp lived a pair of magnificent Arctic hares that seemed to accept us without question as a part of the landscape.

On one occasion we were fortunate in encountering a polar bear that was stalking a seal asleep on an ice cake off shore; as he galloped away from one ice cake to the next, evidently more in surprise than in fear of the plane, it was clear that we were unwelcome intruders in his realm.

Although we were in search of plants that lived in the Arctic long ago, it is hardly possible to ignore the living. In late June the lower slopes were dotted with patches of a lavender saxifrage, by far the most showy of the 30-odd flowering plants we collected, although a close competitor was a yellow poppy that came into bloom in mid-July. Although less colorful than these two, the Arctic willow was most abundant. Growing perfectly prostrate, it formed rather dense mats over the rocky ground and developed a little more luxuriantly in the lee of banks, where it gained some protection from the wind. There were several other saxifrages, a few members of the mustard family, one lone patch of a magnificent purple evening primrose—and occasional dandelions!

Although less colorful, the grasses and sedges are fairly well represented and in late July cotton-grass, with its lovely white ball-like heads, put on a welcome display in the boggy ground not far from the tent. Lichens are abundant in this part of the island, and we gathered about a dozen different mosses.

The long, cold, and dark winter, with temperatures ranging down to 50° below zero, offers a serious obstacle to plant life but an equally rigorous one is the very low rainfall. For the three-year period, 1959-61, annual precipitation at Resolute Bay equaled about six inches, while at Eureka, a weather station on Ellesmere some 200 miles north of our camp, there was only a little over two inches per year, resulting in extreme desert conditions.

As a result of a month's search in the vicinity of our Goose Fiord camp and at another locality some 40 miles to the north, we were able to box up several hundred pounds of fossil plant specimens. A thin coal seam was located which we hope will yield spores, but most significant are specimens of *Archaeopteris,* the fern-like plant that may have been a forerunner of the early seed-plants. At two localities we found reproductive structures and a few precious fragments that are petrified, showing well-preserved internal structures.

These were discovered somewhat accidentally. A few days after our arrival at Goose Fiord we set out to reach the icecap that covers the plateau some seven or eight miles to the east. Unable to follow our planned route because of streams pouring down from the melting ice field, we detoured far to the north and in so doing encountered extensive ledges with a magnificent display of stem impressions. Some of these represented trees of ten inches in diameter, quite in contrast to the diminutive vegetation of the blue wall of ice as shown in one of the photos. We could readily visualize the forest of 300 million years ago where the icecap now covered the plateau. In order to study this spot more carefully we set out to reach it again about a week later; this time we followed what we hoped would be a more direct route that had been plotted roughly from a reconnaissance flight in the plane. It must be admitted that my routing was not perfect and the distance covered was probably greater than on the first venture, partly because we ascended the wrong spur out of the valley; but it was on this spur, only a few hundred feet above the valley floor, that we found the petrified fragments of the leaf stalk and its branches. These are in an initial stage of laboratory study but clearly promise to reveal exciting new aspects of the plant.

Thus a mistake in routing and frustration by a glacial stream led us to our most important find. We are now sure that future visits, with or without mistakes and frustrations, will yield much more about the ancient forests of the Arctic.

Comment / Academic Freedom at Home

"WHAT RIGHT HAS THIS MAN?," the special insert in this issue, was prepared by Editorial Projects for Education, Incorporated, as a report on the current position of the concept of academic freedom in this country. It was based on an extremely thorough examination of the problem in every part of the country and in every kind of institution of higher learning. Naturally, the composite picture fits no one section of the country, nor any one institution. Academic freedom at Swarthmore may not mean exactly the same thing as academic freedom at the University of Mississippi.

What about Washington University? How do we feel about academic freedom here? Well, naturally, we're all for it. We're for academic freedom and we're against sin. Everybody is. Of course, it really isn't that simple. Everybody is for academic freedom, but everybody defines the term to suit his own ideas. What matters is not what people say about it, but what they do about it; what counts is what happens when the abstract principle of academic freedom is translated into concrete cases.

Like any college or university worth its salt, Washington University has come under fire from critics who would abridge or deny the right of academic freedom to those with whom they disagree. The University has been attacked for tolerating the expression of unpopular opinion by some of its faculty members, for not taking disciplinary measures against student peace marchers, for inviting certain speakers to the campus. It is virtually impossible for an institution as large and as complex as a university to do *anything* without arousing *somebody's* opposition.

A few years ago, Washington University was picketed by the Reverend Bill Beeny and his followers, who carried signs urging that the University be investigated and others asking "Is Washington U. a Nest of Reds?" The Beeny pickets were objecting, it seems, because Linus Pauling, the Nobel prize-winning chemist, had spoken at the University in favor of banning nuclear tests. Moreover, some faculty members had supported Pauling's position. There were some who felt that it would have been entirely within the bounds of academic freedom to have dismissed those professors who publicly agreed with Dr. Pauling. University authorities ignored both the pickets and their demands. As an institution, the University took no position one way or the other on the Pauling proposal or on nuclear tests. Its only position was that the faculty members who supported the proposal had a right to do so—and so did those who opposed it.

There is also a small but constant number of alumni who write to say that they will not support the University until the University fires one professor or another with whom the writers disagree. Fortunately, these few alumni, though vocal, are a tiny minority of the whole alumni body. In December, 1961, the Alumni Federation of Washington University unanimously passed a resolution endorsing the principles of academic freedom and urging all alumni to support them. The resolution stated, in part:

"As we view academic freedom, the teacher must be free to teach and as an individual to express what he believes to be true. He speaks always for himself and never for Washington University; and, thus, in this environment freedom abounds—freedom to inquire, freedom to criticize, and freedom to be criticized for what is said. We acknowledge that the search for truth is the legitimate concern of the entire community; the function of academic freedom is to raise this search above the level of economic pressure and coercion."

From the days of William Greenleaf Eliot on, Washington University chancellors have been noted for their adherence to principle and their refusal to bow to pressure. The founders of the University dedicated the institution to freedom of religious belief and this tradition has been applied just as strongly to secular opinion. In recent years, both Chancellor Shepley, a prominent Republican, and Chancellor Eliot, a former Democratic congressman, have demonstrated their belief not only in the abstract principle of academic freedom, but in its impartial application in specific cases.

Academic freedom is a peculiar right; we like to accord it to our friends and to deny it to our opponents. Many of those on campus who applauded giving Linus Pauling a platform from which to attack nuclear tests resented giving the same platform to Edward Teller to defend them. Many campus advocates of academic freedom thought it proper for Arnold Johnson of the Communist Party of America to speak on campus even though they did not agree with him; some of these same people thought it improper to invite William Buckley to talk.

As the national report in this issue demonstrates so powerfully, the question of academic freedom is not a simple one; it is a complex, delicate, and subtle concept which cannot be separated from the larger issues of our society nor untangled from the very fabric of our lives.

THE PHOTOGRAPHS ILLUSTRATING the article on cancer research in this issue of the Magazine represent just a few of the hundreds of pictures Herb Weitman took at the School of Medicine on this story. Herb did more than just take pictures: He spent weeks at the Medical School, interviewing doctors and researchers, talking to patients and nurses, digging up data, compiling statistics, checking facts. He donned mask and gown for the operating room shots, looked through the electron microscope, and helped fashion glass microtome knives. He was not only the photographer on this story, but the researcher, reporter, and producer as well.

All the editor had to do to write the copy was to sit down with the information Herb had assembled and get it down on paper. —*F'OB*

UNSUNG HERO OF the cancer research described in this issue of the Magazine is the laboratory mouse. This little creature is the aristocrat of the rodent world, with a detailed pedigree extending back hundreds of generations. To eliminate random factors and to insure uniform results in experiments, laboratory mice are bred to the purest strains.

By the thousands, these little animals are used to help test new methods of chemical therapy, surgery, and radiology; to provide data on the role of diet, temperature, and other environmental factors; and to furnish information on the role of heredity in cancer.

Together, they have saved many lives and have helped to eliminate much human suffering.

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